THE CONDOR

A Magazine of Western Ornithology

Volume 43 July-August, 1941 Number 4

COOPER ORNITHOLOGICAL CLUB

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A Magazine of Western Ornithology

Published Bi-monthly by the Cooper Ornithological Club
Entered as second-class matter May 15, 1925, at the post-office at Berkeley, California, under Act of Congress of February 28, 1925, Section 412, paragraph 4.
Issued from the Office of THE CONDOR, Museum of Vertebrate Zoology, Berkeley, California.

SUBSCRIPTION RATES

Three Dollars per Year in the United States, payable in advance.
Fifty Cents the single copy.
Three Dollars and Twenty-five Cents per Year in all other countries in the International Postal Union.

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Dues are payable in advance on January first for the calendar year: Three Dollars per year for members residing in the United States; Three Dollars and Twenty-five Cents in all other countries. Members whose dues are paid receive THE CONDOR without additional charge.

The Life Membership fee is Seventy-five Dollars. No additional dues are required, and the money is invested and the interest only is used for Club publications. Life Members receive The Condor without additional charge.

Send manuscripts for publication to the Editor, ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley, California, or to the Associate Editor, JEAN M. LINSDALE, same address.

Send dues and subscriptions to JOHN McB. ROBERTSON, Associate Business Manager, Buena Park, California; orders for back numbers of THE CONDOR and the PACIFIC COAST AVIFAUNA series to W. LEE CHAMBERS, Business Manager, 2068 Escarpa Drive, Eagle Rock, California.

Issued July 15, 1941

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BIRDS OF A PRAIRIE COMMUNITY

By S. CHARLES KENDEIGH

With white man rapidly penetrating and disturbing the last remnants of pristine plant and animal communities on the North American continent, it is desirable to record the biological composition and dynamics of such communities before further modification takes place. Even now such studies often must be made, if at all, on areas where the plants and animals, formerly disturbed, have been allowed to return and re-establish somewhat limited natural relations. The present report concerns such a restored prairie community (fig. 40) of approximately fifty acres situated next to the Iowa Lakeside Laboratory, near Milford, in northwestern Iowa, on the west shore of Lake Okoboji. The study covered the period from early June to mid-August, 1940.

Vegetation.—The area is not entirely typical prairie. Formerly it was pastured, but parts of it were never plowed. For about the last twelve years it has been left alone, and two or three inches of dead grass debris have accumulated over the ground. As evidence of former disturbance, the Kentucky blue grass (*Poa pratensis*) is by far the most important species, constituting 25 to 100 per cent of the vegetation in various parts of the area. On the higher knolls, the vegetation approaches more nearly that of true prairie and consists of the grasses, *Poa pratensis*, *Andropogon furcatus*, *A. scoparius*, *Sporobolus heterolepas*, and *Stipa spartea*. Over sixty-five species of plants occur on the area, the principle forbs being an aster (*Aster multiflora*), a golden-rod (*Solidago rigida*), a lead plant (*Amorpha canescens*), a ragweed (*Ambrosia artemisiifolia*), and a vervain (*Verbena stricta*). I am indebted to W. A. Anderson, State University of Iowa, for help with the plant taxonomy of the area. The vegetation is not entirely stabilized, although little yearly fluctuation is evident. The annual weeds have been largely eliminated by the *Poa*, and there is some evidence that the prairie grasses are expanding at the expense of *Poa*. There appears to be some invasion of box elder (*Acer negundo*) into the *Poa* grass along the south side. Small bogs and a kettle hole occur with aquatic vegetation, and in some of the ravines and along the shore of Millers Bay occur willows (*Salix* spp.) and cottonwood (*Populus balsamifera*). There are a few scattered clumps of buckbrush (*Cephalanthus occidentalis*) and weed patches with grape (*Vitis* sp.) along the boundary fence.

This area is near the center of the True Prairie Association in the Stipa-Antilocapra Biome described by Clements and Shelford (Bio-ecology, 1939, John Wiley and Sons). It is surrounded by pasture and cultivated farmland, except on the south where it contacts a forest-edge of box elder, green ash (*Fraxinus pennsylvanica lanceolata*), wild plum (*Prunus nigra*), and, farther back, bur oak (*Quercus macrocarpa*). This oak is the outermost representative of the Deciduous Forest Biome that covers the eastern part of the country.

Climate.—The only climatic data available for the vicinity are from Lake Park, ten miles to the northwest, and information is available only for temperature and pre-

Fig. 40. View looking north over the prairie near Milford, Iowa. The light-colored grass in the foreground is Kentucky blue grass; the darker grasses on the distant hills are true prairie grasses.

cipitation (table 1). These data were kindly furnished me by Charles D. Reed, Senior Meteorologist, Des Moines, Iowa.

TABLE 1.

Climatic data for summer months at Lake Park, Iowa

Month	Record	Temperature Mean Monthly	Mean Minimum	Mean Maximum	Total Precipitation
May	Normal	57.6° F.	45.4° F.	69.8° F.	4.02 in.
	1940	56.8	43.7	69.8	1.46
June	Normal	66.6	55.0	78.2	3.93
	1940	68.2	57.0	79.4	5.57
July	Normal	72.1	60.5	83.7	3.32
	1940	75.0	62.5	87.6	0.52
August	Normal	69.4	57.5	81.3	3.68
	1940	68.4	59.0	77.7	4.00

During the nesting season of 1940, it is evident, temperatures were approximately normal, but the precipitation fluctuated, being far above normal in June and August and well below normal in May and July.

Bird Population.—Group A in table 2 lists the population of strictly prairie species, that is, those species that passed practically all their breeding season in the prairie itself and depended on it for nest sites, food, and shelter. It may be a surprise to see the Ring-necked Pheasant included here, but it appeared to have some of the habits of a prairie bird and may be thought to occupy now the niche formerly taken by the Prairie Chicken (*Tympanuchus cupido*). However, after the young hatched they were usually conducted into the wooded ravines and forest-edges.

In addition to those species that both nested and fed in the prairie there are those that nested in the near-by forest-edge or marsh but did most of their feeding in or over the prairie (group B). All species listed, except the Kingbird, ranged over an area larger

than these fifty acres. Mention might be made here also of a single female Mallard (*Anas platyrhynchos*) with a newly-hatched brood of young that was found in a nest in the middle of the area. Probably its presence depended on the near-by lake and marshes.

A third group of species includes those that occurred in the forest-edge and along stream and lake margins (group C). The forest-edge is formed by the inter-penetration of forest and prairie. These birds commonly both nested and fed in this transition area or at least did not penetrate into either the prairie or forest to any great extent, although they occurred elsewhere in more open seral stages leading up to a climax forest. The Crow's habits were somewhat different from those of the other species listed, in that it

TABLE 2.

POPULATION OF PRAIRIE BIRDS ON FIFTY ACRES

	NUMBER OF BIRDS
Group A. Species that both nested and fed on the prairie	
Bobolink, *Dolichonyx oryzivorus*	16
Grasshopper Sparrow, *Ammodramus savannarum*	16
Ring-necked Pheasant, *Phasianus colchicus*	14±
Western Meadowlark, *Sturnella neglecta*	6
Group B. Species that nested elsewhere but fed on the prairie	
Barn Swallow, *Hirundo erythrogaster*	5±
Purple Martin, *Progne subis*	5±
Kingbird, *Tyrannus tyrannus*	2
Sparrow Hawk, *Falco sparverius*	2
Marsh Hawk, *Circus hudsonius*	2
Short-eared Owl, *Asio flammeus*	1
Group C. Species confined chiefly to the forest-edge	
Yellow Warbler, *Dendroica aestiva*	18
Alder Flycatcher, *Empidonax traillii*	4
Crow, *Corvus brachyrhynchos*	2
House Wren, *Troglodytes aëdon*	2
Catbird, *Dumetella carolinensis*	2
Song Sparrow, *Melospiza melodia*	1
Group D. Species confined chiefly to seral communities	
Yellow-throat, *Geothlypis trichas*	8
Red-winged Blackbird, *Agelaius phoeniceus*	2

commonly fed in the surrounding farmland. Additional species occurred in seral stages of the prairie and confined both their nesting and feeding to these communities (group D).

Of strictly prairie species (group A) the average population amounted to only 1.0 bird per acre. If all species are included that use the prairie either for nesting or feeding, the population is raised to about 1.4 birds per acre. If the population is based on species found in all habitats associated with the prairie, the average population is increased to 2.2 birds per acre.

Undoubtedly if a much larger area could have been included in this study a somewhat greater variety of species would have been listed. Burrowing Owls (*Speotyto cunicularia*) are reported to have occurred formerly in this area but are now absent. In the near-by Montgomery prairie, a brief half-day census of about 150 acres of an unplowed area that is annually cut for hay and is dominated almost exclusively by *Stipa spartea* revealed the Bobolink as the most numerous species; pheasants, Western Meadowlarks, Grasshopper Sparrows, three Upland Plovers (*Bartramia longicauda*) and a pair of Savannah Sparrows (*Passerculus sandwichensis*), the latter near the margin of a slough, also were noted.

Clements and Shelford (*loc. cit.*) list as strictly prairie birds of this association the Prairie Chicken, Eastern Meadowlark (*Sturnella magna*), Dickcissel (*Spiza americana*), Field Sparrow (*Spizella pusilla*), and Horned Lark (*Otocoris alpestris*). Inclusion of the last four species needs qualification. The transition from the range of the Eastern to the Western Meadowlark is somewhat gradual. The eastern species predominates east of the Mississippi River where it appears in the tall grass prairie and in grassy seral stages of the deciduous forest. West of the Mississippi River the Western Meadowlark assumes a more important role and at least in the northern part of the True Prairie is almost exclusively the species present. Dickcissels were common in the general area, but none occurred in the prairie under study. The impression gained was that this species belonged not to climax prairie but to seral stages with sparser vegetation and to disturbed areas resulting from agricultural practices. No Field Sparrows were observed except one pair several miles away that had a nest in a low bush. It is a forest-edge species and is not typical of climax conditions in the True Prairie. Horned Larks were observed in the neighborhood but not on the study area. Their breeding season begins early in the spring, and no nests were found in this summer study. Observations of their occurrences indicated that their habitat relations may be similar to those of the Dickcissel. Studies in several areas of course are desirable before a list of typical species in this prairie community can be drawn up with any degree of certainty.

Territorial Relations.—Some attempt was made to study the territorial interrelations of these birds even though mating was already nearly complete and nesting well begun by the time the study was started. Maps were prepared showing the location of nests or territories of each species.

Two nests of the Western Meadowlark were found (fig. 41), both with eggs at the time. The first nest with six eggs was well concealed in *Poa pratensis* under a clump of *Solidago rigida*. The eggs hatched June 20 but the young were gone on June 29, and probably had been destroyed. The second nest was under a tuft of *Andropogon* and had a tunnel a foot long, slightly curved, leading to it. The eggs hatched July 4, and two of the four young successfully left on July 15 or 16. Possibly there were earlier nesting attempts than these reported.

Territorial behavior is well established in this species, although only the male defends the territory. At least two variations of song were given from singing posts, and a song was given occasionally while flying. Flight songs were not so frequent as one might expect. Possibly they were given more often during the earlier mating season. Most of the singing was from fence or telephone poles or from tall weeds or small trees. The song served as an advertisement to other males that the area was occupied. When another meadowlark encroached on the area or simply flew high over it, the male met the challenge and gave chase until the intruder passed the limits of the owner's jurisdiction. The females, on the other hand, were at no time observed to be concerned about territorial boundaries.

As soon as nesting was over, the meadowlark territories were no longer defended, and singing ceased except for occasional outbursts. Through July six to a dozen or more meadowlarks were seen frequently in the evenings as they went to roost in the grass within the former territory of the male of nest No. 1 or in other parts of the area. Male No. 1 was not a member of this group; his tail had been clipped for recognition purposes. These birds did not roost on any perch above the grass cover. Although they could not be observed at very close range, it appeared that they passed the night on the ground under some clump of grass, where they were relatively well protected. During the day they fed in the near-by prairie or more frequently in areas outside of the tract under study.

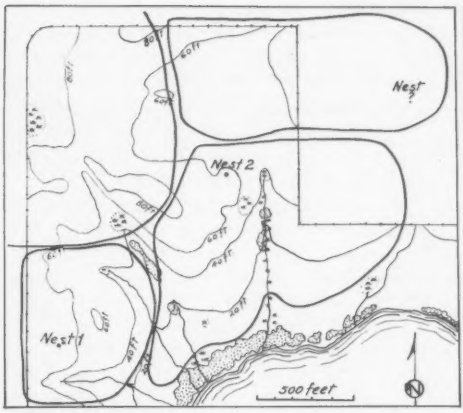

Fig. 41. Territories of the Western Meadowlark.

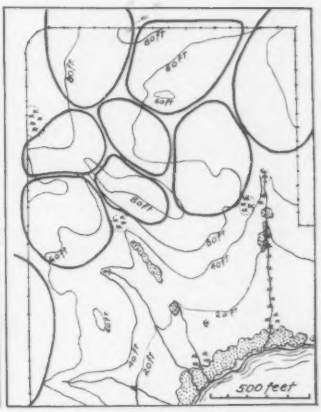

Fig. 42. Territories of the Grasshopper Sparrow.

In computing the bird population only three pairs of meadowlarks were counted for the area although four territories were represented. Three of the four territories extended well outside the area under study. The male at nest No. 1 had the smallest territory of approximately 10 acres. The male at nest No. 2 at various times maintained rights over about 24 acres. The other two territories were about 21 and 32 acres, respectively, as near as could be estimated.

As is evident in figure 42, Grasshopper Sparrows were largely confined to the northern part of the area where the prairie grasses were better developed. None was observed at the lower elevations nearer the lake where blue grass predominated. Less time was given to work with Grasshopper Sparrows. No nests were found, although adult males were seen defending territories, heard singing their inconspicuous song from the top of weed stalks, and adults were seen carrying food presumably to young. The approximate territories were marked out on the basis of repeatedly observing birds in the same places on different days. The average size of the six territories shown is 3.4 acres.

Ten nests of Bobolinks were found, all containing young birds at the time and probably representing all the nests of this species in the area. Five of the nests were well concealed in the base or under clumps of *Andropogon* grass, four nests were in *Poa pratensis* and were not so well concealed or protected from the sun, and one nest was under *Stipa spartea*. Of seven nests not unduly disturbed by human interference, four had their young leave successfully after ten or eleven days in the nest. There were ten females here, but evidence for no more than six males, with polygyny strongly indicated. The male at nest No. 1 (fig. 43) was frequently present also at nest No. 7 about 200 feet away, although he was only seen to feed the young at No. 1. He was recognized by the characteristically clipped tail given him when caught at nest No. 1; no other male was seen around nest No. 7. Nests number 9 and 10 were separated by only 44 feet and the male appeared equally concerned for both nests, although he was observed feeding young only at number 9. No other male was seen here. When nest number 4 was found, one male and three females became excited; possibly the females were those from this nest and from 5 and 3. It was also characteristic at both 1 and 9 that both females responded to the alarm call of their common mate. When the female was captured at nest 4, she

deserted, and the male attempted to raise the young in this nest alone, devoting all his attention to them, but he failed. During this period no other male was observed at nest 5 or at nest 3. Nest 5 was roughly 150 feet from nest 4 and 470 feet from nest 3. Nest 3 seemed rather far removed to belong to the same male as nests 4 and 5. However, mere nearness of nests to each other is not evidence that they belong to the same male, as

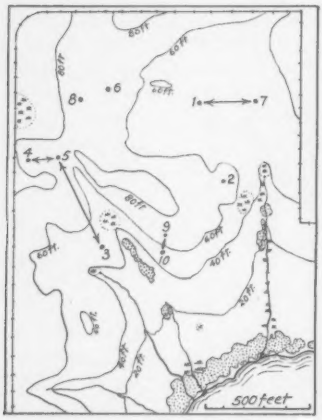

Fig. 43. Locations of nests of the Bobolink. Arrows join nests belonging to the same male.

Fig. 44. Locations of nests of the Ring-necked Pheasant.

nests 6 and 8, which were only 180 feet apart, certainly belonged to different males. All attempts to prove that the same male was simultaneously associated with two or more nests by capturing them at each nest were unsuccessful. Failure resulted because the young were fed regularly by a male at only one nest and because of the high nest mortality. Polygyny is well known among some other members of the Icteridae, but to prove it definitely for the Bobolink would require study during the actual mating period.

Notable in this species was the lack of territorial defense by either the adult male or female. If these birds establish a territory at all, it must be only for the mating and early nesting period. The fairly good spacing of the nests over the area would indicate that they may establish territories during the period when nests are started, but certainly after the young are hatched there is very little evidence for their continued maintenance. Although the males sang from tall stalks of grass or forbs while aiding the female in feeding the young and also sang during flight, the singing was neither frequent nor vigorous except when the bird became excited or alarmed as, for instance, when I approached the nest. Furthermore, the males were by no means confined to the neighborhood of their nests. On several occasions different males were observed to rise high into the air and fly straight away for a half mile or a mile, well beyond the range of 8x glasses. Then after a time the birds would be found back at their nests. Lack of territory was also manifested by the tolerance of other males close to the nest. This was often noticed; once two foreign males were observed near the nest with the male who owned it disregarding them. Frequently when a male from a neighboring nest left to procure food, he would stop temporarily near the nest of the male under observation before proceding onward. These males usually did not sing or call during their visits.

Nine nests of the Ring-necked Pheasant (fig. 44) were found on the area. Each was possessed, no doubt, by a different female, but the number of males could only be guessed. Males were frequently heard or seen; certainly there were less than nine. Excrement was commonly seen all over the area, and isolated eggs were frequently found. Nothing could be ascertained concerning territorial relations in this species, although the regular spacing of the nests suggests a possibility that territorial relations of some sort exist at an earlier period.

Although only nine pairs of Yellow Warblers can be counted for the prairie area under study, a total of 34 nests were seen around the laboratory grounds, and certainly not all the nests were found. In figure 45 certain nests and territories to the east of the prairie area are also shown, as they were subject to special study. Of 21 nests, 2 had three eggs or newly hatched young birds, 12 had four eggs or young, and 7 had five eggs

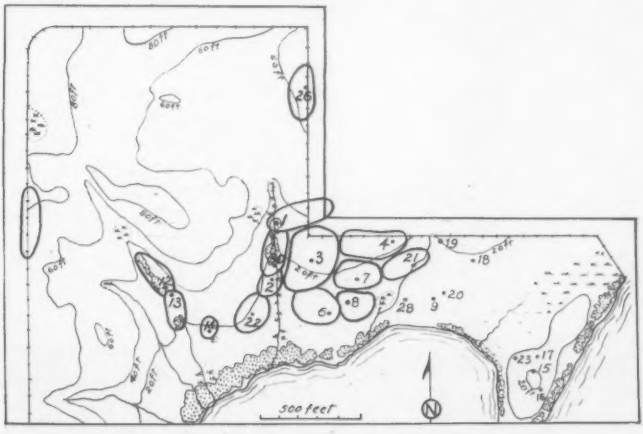

Fig. 45. Locations of territories and nests of the Yellow Warbler.

or young. Three nests were double in that a second nest was built over the first one which contained a Cowbird egg as well as the warbler eggs. In no instance did the warbler lay another set of eggs in the upper nest. Yellow Warblers here do not have a second brood, and there is some question whether the female will lay again in event the first egg-laying cycle is interrupted or the first nest destroyed. An adult, in some cases certainly the male, was observed a number of times to persist in the vicinity of the nest for several days and even to defend the territory, although no progress was made in renesting. When nesting was over, the birds disappeared rapidly, and only a few scattered birds remained after the end of July. The nests were made in large part of the dry and shredded outer fibers of previous year's stalks of milkweed (*Asclepias* sp.), and probably also Indian hemp (*Apocynum* sp.), which plants were readily available in the vicinity. Twelve out of sixteen nests, where data were reasonably satisfactory, had at least some of the young leave the nest.

Twenty out of twenty-nine nests were placed in buckbrush, with the rest in box elder, lilac, willow, or currant. The buckbrush is a low bush usually three to four feet high, growing in rather dense thickets in the open, especially in grassy areas of *Poa* and *Agropyron* (fig. 46). Nests placed here varied between two and three feet above the

ground. The nest found closest to the ground (18 inches) was, however, in a small box elder. In taller shrubs and trees, the nests were found up to about seven feet above the ground. Strangely, no nests were located in willows on the shore of the lake. Some nests were found in isolated buckbrush thickets only a few feet square, while in one large thicket, 180 by 120 feet, two nests were situated in opposite corners. Size of the thicket seemed not to be a limiting factor in the selection of a nest-site. Many thickets both smaller and larger than ones with nests did not contain any. The age of the bush did seem to make a difference. During the first year or two the plant shoots straight up, but in later years numerous side branches develop which later also turn upwards so that vertical crotches between the branches make secure nest-sites. With one or two exceptions, brush less than five or six years old was not used. Furthermore, the density of the thicket was important, but this was a function not so much of its size as of its age. Thickets that were open, with the individual shrubs widely spaced, only rarely contained nests. Cover for concealing the nest was therefore a factor.

These warblers possessed territories that averaged about 150 feet in diameter, or approximately two-fifths of an acre. Even in locations where trees were included, the territories appeared to be of about the same size. The limits of the territory often did not coincide with the boundaries of the thicket in which the nest was located but extended over the neighboring grassland and often included parts of neighboring thickets. These territories were defended by the males partly by singing, although in shrubby areas lacking trees (fig. 46) they were handicapped by lack of singing posts from which to proclaim their ownership and to advertise themselves. A few made use of fences from

Fig. 46. Nesting area of the Yellow Warbler east of the prairie and looking south across Little Millers and Millers bays. Note patches of buckbrush in foreground in which birds nested and forests in background where they frequently went to procure food.

which to sing and also of tall posts and wire from an abandoned electric line that extended through this area. The role of the female in defense of territory was not determined.

Probably due to this lack of singing posts and to the unusual abundance of birds, chasing was also extensively used as a defense measure, and during the height of the nesting season squabbling birds were a common sight all over the area. At times it was suspected that much of the chasing was after the bird's own mate, although this could

not often be verified as the individual identity of the shifting birds was very difficult to ascertain. Neighboring males seemed to lack any conception of the limits of each other's territories and moved about indiscriminately until chased out. No actual fighting was observed. The resulting confusion may be laid to the inability of the birds clearly to define the limits of their territories by singing, which was not possible for lack of singing posts of suitable height. In other parts of the area where trees were available, the males commonly sang at a height of 18 feet, often up to a height of 45 feet, and chasing was not often observed.

Another cause for confusion was the lack of typical areas for feeding within the territorial boundaries. This species ordinarily gets most of its food in trees and taller shrubs similar to those from which it sings. Since such shrubs and trees were lacking in their territories, the birds regularly left for feeding. Occasionally they were seen to dart down into the grass, and they obtained some food from the buckbrush, yet this was not sufficient. Commonly they went to the willows, 400 to 600 feet away at the edge of the lake. The birds from nest 26 (fig. 45) were observed going in that direction, 1200 feet away. Sometimes birds did not stop at the lake margin but went on, flying across Millers Bay, to a bur oak forest on the opposite shore. This was regularly observed; it involved a round trip of at least 3200 feet, three-fifths of a mile. Certainly they did not go so far for every morsel they fed the young, but the male at nest No. 4 was seen to do so twice in fifteen minutes of observation, making each round trip in about five minutes. Frequently, although not invariably, these birds on their outward journeys mounted high into the air to fly over the intervening territories of other birds. Even then they were often chased, but less frequently than on their return trips, when laden with food and at the end of the long flight they passed low over neighboring territories to reach their own. This behavior added to the confusion of territorial relations and explained much of the chasing and competition so frequently observed. In adjacent areas where a sufficient number of trees or tall shrubs were available the birds were more nearly confined to their territories, and these long journeys were not observed. Where all requirements for nesting are not found in any one area, this species appears capable of modifying its behavior to make the best of conditions available.

Discussion.—This report cannot be considered to give a true picture of bird conditions in the pristine prairie until similar studies can be carried out in other relic areas, preferably of larger size. The great abundance of *Poa pratensis* in this area introduced a modifying factor. True prairie species of grasses were not present in their proper abundance, proportions, and position. Some of the ground, now covered by *Poa pratensis*, may originally have been bare space between the prairie bunch-grasses. Likewise the thick layer of dried grass covering the ground is probably not normal for primitive conditions. The Dickcissel, Horned Lark, Lark Sparrow (*Chondestes grammacus*), and other species might have occurred if the grass cover had not been so dense and continuous. Likewise the pristine modifying influences exerted by trampling bison and antelope, and the burrowing of pocket gophers and badgers, may have produced conditions favorable for other species to nest. Such habitats are now better found in certain farmland and on roadsides. Since they result from human influence, they are difficult to fit into the picture of what original prairie looked like.

When the exact habitats of different species are found and their abundance in each determined, the next question that arises is why each species is restricted to particular places. How the prairie is used by strictly prairie species has been indicated. These uses seemed easier to determine than in the case of such forest-edge birds as the Yellow Warbler. When analysis of special features required in the habitat is carried back far enough,

it leads into the physiology of the bird and to questions of innate behavior. For example, the young of Bobolinks and meadowlarks occur in grass nests on the ground and are not attacked by the abundant biting ant (*Formica cinerea neocinerea*) until they die or become weakened as by lack of food. However, when nestling Yellow Warblers were placed in a trap on the ground for short periods of fifteen to thirty minutes, they were quickly attacked. Is this one reason the Yellow Warbler does not nest on the ground? What gives the active young of ground-nesting species protection? Many prairie species have flight songs which compensate for lack of singing posts, and they commonly sing from low perches close to the ground. Why does the Yellow Warbler require a song post eighteen feet or more above the ground? The simplest explanation and perhaps a proper one is that it is due to behavior patterns inherited from the past and developed through evolution; but this only begs the question, since it leaves unexplained why and how the peculiar behavior patterns were evolved.

SUMMARY

The size and territorial relations of a bird population was studied on a fifty-acre tract of True Prairie in northwestern Iowa belonging to the Stipa-Antilocapra Biome.

Four species were mostly confined to the prairie for all their activities, six species nested in the forest-edge or marsh but fed largely in the prairie, six species were largely confined to the forest-edge, and two species occurred only in seral stages of the prairie.

The four most typical prairie species averaged 1.0 bird per acre in abundance, but if all species that used the prairie to at least some extent be included, the population is raised to 2.2 birds per acre.

The Western Meadowlark and Grasshopper Sparrow had well-defined territories, averaging in size about 2.2 and 3.4 acres, respectively. The Bobolink and Ring-necked Pheasant appeared not to possess territories after mating had been completed, and there is evidence that both species were polygynous.

A special study of the Yellow Warbler indicated that territorial requirements included suitable nest-sites, concealing cover, tall singing posts, feeding areas in trees, and space, and that when certain of these factors were lacking, territorial relations became confused and the behavior of the birds was modified.

University of Illinois, Urbana, Illinois, March 29, 1941.

FEEDING HABITS OF THE BLACK OYSTER-CATCHER

By J. DAN WEBSTER

The best method of determining the food of the Black Oyster-catcher (*Haematopus bachmani*) is to collect the shells scattered around young birds which are being fed by the parents. However, care must be taken to collect only those shells that are fresh, because shells cleaned by the oyster-catchers in previous years, or by ravens, crows, or gulls, are often present, sometimes in large numbers in crevices and crannies of the rock.

The data here presented are based on shells collected on various small islands in Sitka Sound, southeastern Alaska, in 1940. A few of the shells, mostly *Mytilus edulis*, were collected from spots where birds had been observed foraging, immediately after they had left.

Mytilus edulis. Common Mussel. Found on mud flats in sheltered bays; most abundant in the mid-tidal region. Forty-five shells of this mussel opened by oyster-catchers averaged 41.1 mm. in length by 19.3 mm. in width. The largest shell opened was 57 mm. by 23 mm.; the smallest shell opened was 27 mm. by 14 mm. Eighty-five living mussels chosen at random from a scalp averaged 45.6 mm. in length. This shows, as Dewar (1915) found with the English Oyster-catcher, that the Black Oyster-catcher has a decided preference for medium-sized mussels.

Mytilus californianus. California Mussel. Abundant on exposed, rocky shores in the upper and mid-tidal regions. Most mussels are attached ventrally; the oyster-catcher fractures one valve in the opening process, and eats the flesh immediately or gives it to the young bird without the shell. But, thirty-two nearly perfect shells were found high on the rocks, near young birds. Evidently these had been pulled loose from the rocks without breakage because they had been attached dorsally, thus weakly (see p. 177). These shells averaged 40.2 mm. by 20.3 mm.; the largest was 60 mm. by 33 mm., the smallest 19 by 10.

Acmaea scutum. Shield Limpet. Found on sheltered and semi-exposed rocky shores in the mid-tidal horizon. Particularly common on the inner, semi-exposed side of such islands as Black Oyster-catchers choose for nesting sites. One hundred and eleven shells averaged 26.1 mm. by 19.8 mm.; the largest was 43 by 37, the smallest 12 by 9.

Dewar (1913:53) found 85 per cent of the limpet shells cleaned by oyster-catchers "whole or only slightly chipped, with the abrasion or fracture always at one edge only, being of any shape." Three hundred and fifty-six shells of this and the following two species of limpets were examined by the writer, who found 38 per cent fractured, 37 per cent slightly chipped, and 25 per cent perfect.

Acmaea digitalis. Ribbed Limpet. Found on exposed, rocky shores, in the mid-tidal horizon, and usually behind boulders or ledges where it does not receive the full force of the surf. Two hundred and twenty-eight shells averaged 25.2 mm. by 18.2 mm.; the largest was 40 by 29, the smallest 13 by 8.

Acmaea mitra. Dunce Cap Limpet. Found on exposed, rocky shores at the low tide horizon, much below the four preceding species. Twenty-four shells averaged 23.2 mm. by 18.8 mm.; the largest was 28 by 24, the smallest 18 by 15.

Katherina tunicata. Chiton. Found on exposed, rocky shores, where it is uncovered only on the lower low tides. Forty-three shells averaged 41.9 mm. by 22.9 mm.; the largest was 73 by 38, the smallest 28 by 15.

Mitella polymerus. Pacific Goose Barnacle. Found on exposed, rocky shores in the upper and mid-tidal regions. Two shells opened by oyster-catchers measured, respectively, 24 mm. by 20 mm., and 25 mm. by 25 mm. All barnacles are opened where found, because they cannot be detached from the rock; if the flesh is fed to the young it is carried to them without the shell.

Nereis sp. Two or three small worms, probably *Nereis vexillosa*, were found among the shells surrounding two chicks that were less than a week old. Older chicks did not refuse the worms, but ate them whole.

It is likely that other shellfish are occasionally eaten by the Black Oyster-catcher. Young abalones are mentioned by Grinnell, Bryant and Storer (1918: 501); near Sitka, small abalones (*Haliotis kamchatkensis*) are common and form a staple food for crows and ravens, yet so far as could be found, they never were eaten by oyster-catchers. A few

shells of keyhole limpets (*Diadora aspera*) were found which may have been cleaned by oyster-catchers. Observations indicated that large individuals of the common barnacle (*Balanus glandula*) were occasionally eaten.

Stomach analyses.—Twelve Black Oyster-catchers, ten adults and two juveniles, were taken in 1940, near Sitka, and their stomach contents noted, as follows:

Cornell Univ. Coll. No.	Date	Stomach Contents
7371	March 5	1.7 gr. of shell, including 13 entire small limpet shells.
7372	April 1	.1 gr. of shell, including 2 entire small limpet shells; flesh of 4 large limpets.
7714	May 2	.7 gr. of shell, including 3 entire small limpet shells; flesh of 2 large limpets.
7892	May 23	.1 gr. of shell; flesh of 21 large goose barnacles; flesh of 26 large limpets; 1 small *Nereis*.
8045	May 23	.3 gr. of shell, including 1 entire small mussel shell; flesh of 10 large limpets; flesh of 1 barnacle; flesh of 4 mussels.
8047	July 12	.3 gr. of shell; hard parts of 2 *Nereis*.
8046	July 12	.4 gr. of shell and gravel; hard parts of 1 *Nereis*.
7889	September 4	1.0 gr. of shell.
7890	September 5	1.0 gr. of shell, including 4 entire small limpet shells; flesh of 4 chitons; flesh of 2 large limpets; flesh of 10 goose barnacles; flesh of 6 mussels.
7891	September 5	1.5 gr. of shell; flesh of 1 large limpet; flesh of 20 goose barnacles.
7888	September 5	.3 gr. of shell.

In the foregoing table, "small" limpets were less than 12 mm. long, save for one which was 15 mm. long. These, of course, like the single "small" mussel found, which was 7 mm. long, had been swallowed whole because too small to permit removal of the flesh from the shell. The shell particles that were found had evidently been chipped from the shell during removal operation and had been swallowed accidentally with the flesh. These shells are ejected by the birds every day or two in pellets, which may be found as small mounds of tiny shell fragments on any oyster-catcher roosting spot.

In an attempt to determine the rapidity of digestion in the oyster-catcher, a caged juvenal bird was fed thirty-five large mussels. Two hours later the bird was killed and the stomach examined. Only a few tough adductor muscles remained undigested in the stomach. The rest of the material was in a semi-liquid state in the intestine, or had already been absorbed.

Feeding methods.—The observations of J. M. Dewar on the feeding habits of oyster-catchers in England are in quality far above those of any other observer. The present writer has endeavored to check and to supplement Dewar's observations and to apply them to the Pacific Coast species.

A mussel's attitude of rest is one in which the valves are separated slightly, because of the tension of the elastic ligament. Dryness would shrivel the internal structures were the mussel at rest in other than moist or submerged situations. Most of the mussels on the banks are attached securely by strands emerging ventrally through the byssal fissure, and the dorsal border is uppermost. In a few instances, however, the mussel is attached dorsally or vertically.

"The oyster-catchers must search for the gaping shells, and the birds are to be seen at these times walking sedately over the banks, their heads directed forwards, and their bills in a position ready to strike. Each Mussell is approached in the line of its major axis, and is submitted to careful inspection" (Dewar, 1908: 204). If the mussel

meets with approval, the oyster-catcher strikes a sharp blow with the point of the bill on the dorsal border, oblique to the long axis of the mussel. This depresses the valve if the mussel is relaxed, thus forming an abnormal gap which will admit the tip of the bill. The mussel has a tendency to close its valves in the abnormal position, thus permitting entrance of the bill an indefinite number of times (see Dewar, 1913: 42). If this blow is unsuccessful, which often is the case, the bird continues the search for other game. When the preliminary blow is successful, the bill is pushed down into the mussel by a number of jerks with great rapidity and force, until the deepest part of the bill lies lengthwise between the margins of the valves. Next the mussel is opened by one or more of several methods.

The simplest method is sidewise leverage, gained by tipping the head or by shaking, which is sometimes successful. Often these actions are followed or replaced by circular leverage; the bird walks around the shell to the left through a quarter circle, or rotates the head on a vertical axis. Another common method consists of lowering the head almost to the ground on one side of the mussel, thus causing the point of the bill inside the shell to press the opposite valve from its fellow. This is often repeated in case of failure (Dewar, 1908:205). Success results, in most cases, in a fracture of the left valve, beginning at the point where pressure is applied.

The oyster-catcher always walks around or lowers its head to its own left side (Dewar, 1908: 205; checked by personal observation of the species under consideration), and this results in asymmetry of the adult skull in the maxillary and lacrimal regions (Stresemann, 1929: 438-439; equally true in *H. bachmani*).

The ventral byssal fissure is the one weak point in the mussel's armor, and the rare shells so placed that this is uppermost are eagerly sought for by the oyster-catchers. Such mussels form the exception to the rule that dried and therefore tightly closed shells are left alone. The valves are opened by one of the methods already described, but usually without fracture. These mussels are sometimes detached after opening and carried to some more convenient location for removal of the meat. Many mussels are located by probing in the mud, where they may be buried as much as an inch and a half; those opened are usually ventral border up.

Removal of the body of the mussel from its shell is a rapid process. This was performed efficiently even by a young oyster-catcher on the day of capture, when it was thirty days old. The greater part of the mollusk forms but a few mouthfuls; large pieces are torn away and transferred to a point within reach of the tongue by jerks of the head. The bird then walks around to the other end for work there, or if the shell is detached, sometimes turns it around. To scrape out the mantle, the bill is used like scissors. It is laid flat on the inner surface of the shell and pushed forward as the points snip away the adherent flesh. After the end is reached, the bill is returned and cuts a parallel furrow, and this is continued until the shell is clean. "This skilful procedure is carried through rapidly without pause, and often without moving the shell. It is seldom seen towards the end of the feeding periods, and at these times shells are to be found in which portions of the mantle remain" (Dewar, 1908: 211). By the ordinary methods, 200 mussels per hour is the maximum speed for opening and eating by a single oyster-catcher.

The writer agrees with Dewar (1913) that the oyster-catcher does not pry limpets from the rock with its bill laid flat. The bird lowers its head, points its bill toward the ground at a low angle, and delivers a sharp push or chipping stroke on the edge of the limpet shell. Small limpets are thus toppled over. (This first stroke has evidently not been observed or not been appreciated by several other ornithologists.) With larger

shells this preliminary stroke which has weakened the limpet's grip and, perhaps, chipped the shell, is followed by firm and laborious pushing, assisted by lateral bill swaying, or a to and fro rotation of the bill. If this does not complete detachment, the bill is forced under the shell, which is levered up and flies free suddenly. The limpet is then seized and carried to a niche or crevice in the rock, where it is detached from the shell by chipping strokes, and then swallowed in one piece. Detachment is often completed by the bird shaking its bill and flicking the shell off its body as the head is raised. Small limpets are thus disposed of in four seconds from the time they were first sighted.

Why does not the oyster-catcher pry with his bill flat? Because he has not the strength to pry off tenacious limpets which have been warned. Wet, relaxed mollusks are the ones sought; these are slightly raised and permit the first tap to give additional advantage or complete victory to the bird (see Dewar, 1913).

In attacking chitons, the first stroke is delivered as on a limpet, but unless the chiton is small and therefore toppled over at once, further quick work is necessary. One corner of the flexible, leathery shell is detached by pushing with the tip of the bill, thus breaking the vacuum set up by the muscular foot of the mollusk. Usually, then, the bill is slipped under, flat side against the rock, and the animal is *cut* from the rock by sawing strokes of the bill. Removal of the animal from the shell is a laborious process, which sometimes takes as much as three or four minutes when a tight-fitting niche for the shell cannot be found. The chiton is much more firmly attached to its shell than a limpet, but contains more food than a limpet of equal length.

The oyster-catcher approaches a barnacle when it is relaxed, taps one valve as it would a mussel, then levers the valves apart by circular leverage. The body of the crustacean is pulled out in a single piece and makes just one bite for an adult oyster-catcher.

The following table represents, in summary, an estimate of the composition by bulk (in per cent) of a Black Oyster-catcher's food over the period of a year:

Acmaea digitalis	30
Mytilus edulis	20
Mitella polymerus	15
Mytilus californianus	15
Acmaea scutum	13
Katherina tunicata	5
Acmaea mitra	1
Nereis sp.	1

Distribution.—It is interesting to note the correspondence of the range of the exposed rocky-shore invertebrate association (*Mytilus californianus, Pisaster ochraceous, Mitella polymerus, Acmaea digitalis*), which extends from Point Concepcion to the western Aleutians (Ricketts and Calvin, 1939), and that of the Black Oyster-catcher. Although the quiet-water shellfish are important, in stormy weather particularly, *Mytilus californianus, Mitella polymerus* and *Acmaea digitalis* certainly form three-fifths of the food consumed by an oyster-catcher in the course of a year.

The distribution of *Haematopus bachmani* should be stated as: resident on the Pacific coast of North America from Kiska Island, in the Aleutians, east and south to Abreojos Point, on the west coast of Lower California. One record (Hanna, 1920:253), January 12, 1917, from the Pribilofs. Breeds on surf-beaten rocky islands and headlands and along the coasts of the Gulf of Georgia; in winter the birds gather into flocks, but do not wander more than thirty miles from their nesting places.

Migration of the species has never been noted, although Howell (1912:189) saw a single bird flying north on April 13, six miles off the coast of Lower California. Audubon (1839:245) in his original description, however, appended the single word, "migratory," evidently assuming that the western species had habits like those of the eastern. And Dall (1873:28; 1874:274) supported the story when he stated that the birds are summer visitors to Unalaska and the Shumagins, and arrive in the western Aleutians in May. But Dall had not resided in Alaska during the winter! The following authorities state that the Black Oyster-catcher is a permanent resident on parts of the coast about which they, as resident observers, are qualified to speak:

Grinnell (1928:100), Lower California
Grinnell, Bryant and Storer (1918:498), California
Gabrielson and Jewett (1940:237), Oregon
Bowles (1918:333), Washington
Brooks (1920:32; 1921:151), British Columbia
Willett (1921:128), Craig, southeastern Alaska
Turner (1886:151), Shumagin and Aleutian islands, Alaska

The writer can append the following pertinent records from Sitka, Alaska, in 1940: January 30, two birds at Sitka (David Webster); March 1 to September 5, from two to forty birds each day (personal observation); October 8, one bird in Jamestown Bay (Miss Georgia Conley); November 5, six birds in Jamestown Bay (Miss Ora Kukendall). Oyster-catchers have been seen near Sitka in winter for many years, but no notes were taken until 1940.

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Newark, California, April 5, 1941.

UNUSUAL NESTS OF COLORADO BIRDS

By HUGO G. RODECK

Several years ago workmen from a local roofing company brought to the University of Colorado Museum a domestic pigeon's nest which had been removed from the roof of a business building just off the main downtown corner of Boulder, Colorado. The nest, shown in figure 47, is constructed almost entirely of metal. It measures about 9 inches in diameter and about 3½ inches high. Woven into it are steel, brass, and copper wire, nails, hairpins, safety pins, spectacle frames, watch springs, and other metal scraps,

Fig. 47. Nest of domestic pigeon, composed mainly of metal.

all showing evidence of having been in a fire. A jewelry store on the ground floor of the building evidently was the source of a great deal of the material of which the nest was built, and an incinerator in the alley behind the building solves the mystery of the burning. When found, the nest is reported to have contained a "set" of eggs, but it now contains only one broken shell.

When the writer first visited Science Lodge, the University of Colorado's mountain laboratory, in the summer of 1935, he was surprised to find a family of Mountain Chickadees (*Penthestes gambeli*) nesting in the brain cavity of a horse skull which hung on a tree some three or four feet from the door of a student cabin, and about six feet above the ground. Access to the interior of the skull was through the foramen magnum. Reports showed that presumably these same birds had occupied the skull for some years previously. Since then, each summer the same cavity was occupied by the birds until 1939 when, at the beginning of the season, the horse skull was missing from its accustomed place. In a few days the birds were found to have moved to the

Fig. 48. Mountain Chickadee at entrance to nest in skull of horse.

Fig. 49. Nesting site of Violet-green Swallows in sheet metal sign.

"totem pole", figure 48, a tree stub decorated with horse, cow, and goat skulls about 75 feet from the old location. Here they built their nest in the brain cavity of another horse skull and raised their family practically in the center of one of the principal gathering places for the students, and only a few feet above their heads.

In an instance reported and photographed (fig. 49) by Elliott Miller, of Boulder, a family of Violet-green Swallows (*Tachycineta thalassina lepida*) was reared in the cavity of a sheet metal Kodak sign on the main street of Estes Park, Colorado, only a few feet above the heads of the crowds of people who stroll the streets of this town during the summer.

The most persistent and fearless nest builders among the birds at Science Lodge (altitude 9500 feet, in western Boulder County) are the Western Flycatchers (*Empidonax difficilis*). They nest by preference in and on the log buildings. A nest under the porch of one of the buildings has been occupied every year since 1935 to my knowledge, and for some time before then according to report. The nest is on top of a supporting post about three feet off the ground and within ten feet of the community woodpile where a truckload of wood is deposited two or three times a week, and from where some forty or fifty persons carry wood daily to their cabins. Its disturbed location recalls another nest of the same species in the eaves of the sawmill close to a shrieking power saw.

Another Western Flycatcher has nested for several years on a board between two rafters inside the boiler room of one of the bathhouses. The door stands open all summer and the bird is not disturbed by the visits of the stoker. Still another of these birds found an open door in a temporarily unoccupied student cabin and built a nest inside, above a window. Incubation was well advanced when it became necessary to eject this occupant to allow the cabin to serve its original purpose. It was found impossible to keep the bird away until the nest had been removed.

University of Colorado Museum, Boulder, Colorado, April 21, 1941.

A STUDY OF THE STRUCTURE OF THE HUMERUS IN THE CORVIDAE

By JAMES F. ASHLEY

The identification of the bones of fossil and Recent passerine birds has for long presented a difficult problem. As a step toward facilitating this kind of identification it was decided that an attempt would be made to construct a key to certain of the members of the family Corvidae (crows, jays, and magpies) based on humeral configuration. The humerus was selected because of its variation among the passerines and its relative abundance in fossil deposits. After a survey of the literature on the myology of the shoulder girdle of the Corvidae, it was apparent that a more detailed study of the muscles of the head of the humerus would have to be made before a critical analysis of configuration could be undertaken. The writer wishes to express his appreciation to Dr. Alden H. Miller for his continued interest and criticism of the work.

GLOSSARY

To enable precise reference to characters, some new terms (marked with an asterisk) were coined, and to avoid confusion all terms which have been employed in reference to the humerus are here defined (fig. 50).

Bicipital crest. Internal (ventral) margin of bicipital surface.

Bicipital furrow. Depression medial to palmar ridge.

*Bicipital groove. Oblique groove for blood vessel on bicipital surface.

Bicipital surface. On palmar side of head, delimited laterally by palmar ridge, proximally by ligamental furrow, and distally by the point of contact of bicipital crest with shaft.

Capital groove. Groove between internal tuberosity and head.

*Capital shaft ridge. Ridge running to head from tubercle at proximal end of shaft line.

*Deltoid ridge. Faint ridge forming medial limit of insertion of M. deltoid on anconal surface; distal portion lateral to latissimus ridge usually absent.

*Deltoid surface. Area between deltoid ridge and pectoral crest; area of attachment of M. deltoideus superficialis longus lateralis, lateral part.

External tuberosity. Tuberosity at proximal margin of pectoral crest; Mm. supracoracoideus and deltoideus profundus brevis insert thereon.

*Fossa I. Pneumatic fossa.

*Fossa II. Fossa between pneumatic fossa and capital shaft ridge.

Head. Articular surface at proximal end.

Internal tuberosity. Tuberosity separated from head by capital groove; insertions of Mm. coracobrachialis posterior, subcoracoideus, subscapularis.

*Latissimus ridge. Ridge on anconal surface of insertion of M. latissimus dorsi anterior; adjacent and medial to posterior end of deltoid surface.

*Medial bar (=median crest). Bar or partition from internal tuberosity to floor of fossae; lies between fossae when two are present, or forms medial limit of fossa I.

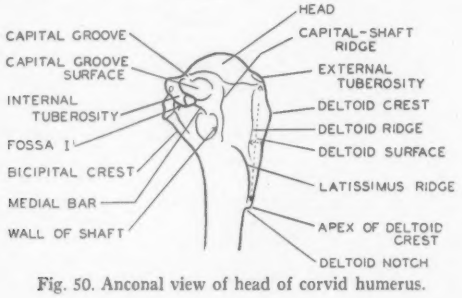

Fig. 50. Anconal view of head of corvid humerus.

*Palmar ridge. Ridge on palmar surface which forms medial limit of area of insertion of M. pectoralis superficialis.
Pectoral crest (=deltoid crest). External (dorsal) margin of deltoid surface.
Pectoral crest, apex of. Distal prominence of pectoral crest.
*Pectoral notch. Notch between apex of pectoral crest and shaft.
*Pectoral surface. Area of insertion of M. pectoralis superficialis, limited medially by palmar ridge.
*Shaft line. Anconal apex of shaft.
*Shaft, wall of. Surface of shaft between floor of fossae and shaft line.

MYOLOGY

The topographical relationships of the brachial muscles throughout the Corvidae exhibit but slight variation. The following descriptions are of the single representative species, the crow (*Corvus brachyrhynchos*) and were derived from four dissections. The muscles were identified on the basis of innervation (fig. 51).

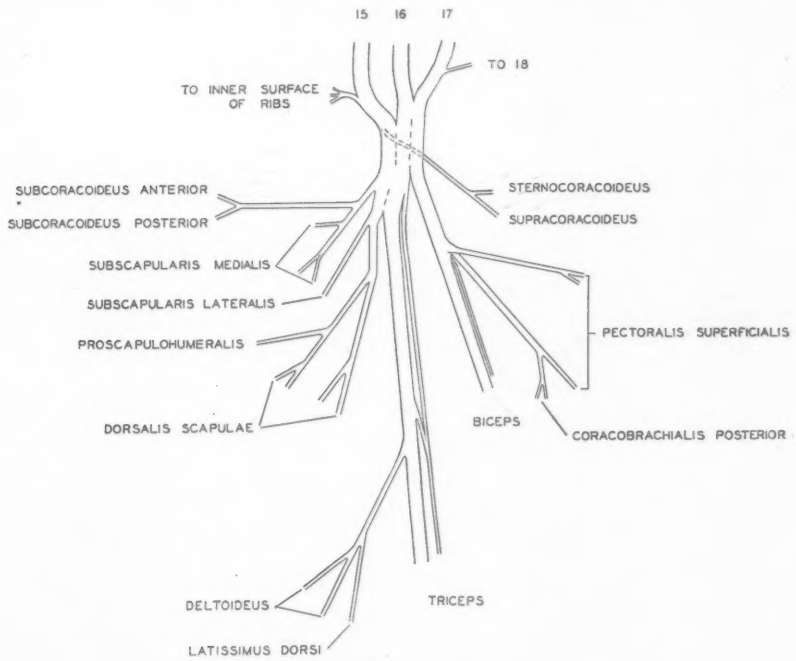

Fig. 51. Brachial plexus of *Corvus brachyrhynchos*.

The desirability of designating avian muscles in terms of those of other tetrapods has been recognized by several workers. For this reason the terminology used here is that of Howell (1937) which takes into account the most advanced views on muscle homology. Gadow (1891), Fürbringer (1902), Shufeldt (1890), and Burt (1930) were used for additional reference.

Drawings of the sternum, furcula, coracoid, scapula and humerus of *Corvus brachyrhynchos* were made with a dioptograph. Areas of origin and insertion of the muscles on

the humerus were taken at the time of dissection and plotted on the drawings of the bones.

Thoracodorsal matrix.—M. latissimus dorsi anterioris. Origin: thoracic vertebrae—spines of third and anterior one-half of fourth. Insertion: humerus—on latissimus ridge of anconal aspect. Innervation: by a twig from N. deltoideus rather than a separate branch from N. thoracodorsalis as in *Gallus*.

M. latissimus dorsi posterior. Origin: thoracic vertebrae—apex of spines of fifth, sixth, seventh, and eighth by light fascia; fascia of M. sartorius—light fascia along posterior margin of proximal portion of muscle. Insertion: M. latissimus dorsi anterior—on fascia of dorsal surface at contact of two slips; humerus—by a weak tendon on small tubercle at distal limit of capital shaft ridge. This is also point of attachment of ligament from os humeroscapularis. Innervation: by bifurcation of twig supplying M. latissimus dorsi anterior.

Axillary matrix.—M. dorsalis scapulae. Origin: scapula—lateral surface of posterior three-fifths of blade. Insertion: humerus—ventral to pneumatic fossa on margin of bicipital crest by a strong tendon; area clearly defined on bone. Innervation: N. dorsalis scapulae.

M. deltoideus; occurs in three main divisions. (1) Superficialis longus medialis. Origin: clavicle—dorsal surface. Insertion: distal to humerus; is in contact with humerus but has no additional origin or insertion thereon. (2) Superficialis longus lateralis; originates as two distinct parts: (a) Lateral part. Origin: scapula—small tendon immediately posterior to origin of pars profunda brevis and by fibers from triangular area on dorsal surface adjoining neck of scapula; humerus—deltoid surface and by a few fibers along a line from deltoid crest posteriorly toward ectepicondyle. (b) Medial part. Origin: Os humeroscapularis and ligaments of shoulder joint. Lateral and medial parts unite one-half length of humerus distally. (3) Profundus brevis. Origin: scapula—oval-shaped area between furcular and coracoidal articular surfaces, deep to anterior part of superficialis longus lateralis. Insertion: humerus—on external tuberosity superficial to insertion of M. supracoracoideus. (Pars profunda longa, described by Howell as occurring in *Gallus*, is lacking in corvids.) Innervation: N. deltoideus.

M. proscapulohumeralis. Origin: scapula—crest of one-fourth of blade immediately proximal to origin of M. dorsalis scapulae. Insertion: humerus—on rounded scar on distal portion of floor of pneumatic fossa. Innervation: by twig from proximal branch of N. dorsalis scapulae. This innervation might lead one to conclude that M. proscapulohumeralis is more closely associated with M. dorsalis scapulae than with M. subscapularis as suggested by Howell.

M. subscapularis. Origin: scapula—proximal two-fifths of lateral surface of blade, the two distinct parts of muscle separated axially by origin of slip of M. serrati. Insertion: humerus—by a

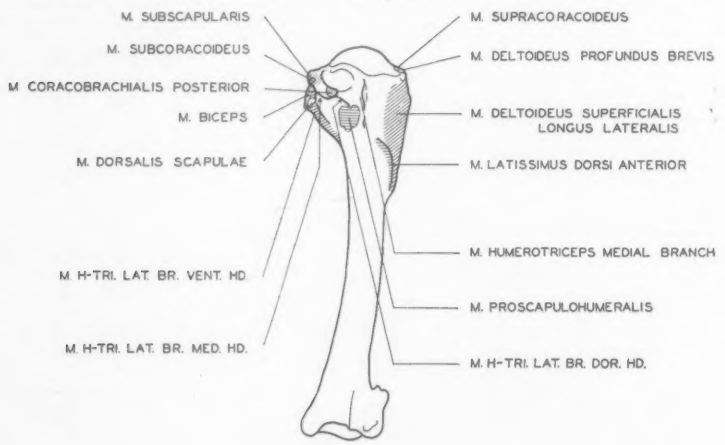

Fig. 52. Humerus of *Corvus brachyrhynchos*, x1, showing areas of muscle attachment on proximal end.

common tendon on internal tuberosity immediately distal to tendon of M. subcoracoideus. Innervation: medial portion innervated by a dorsal branch of N. subcoracoideus. Lateral portion, contrary to the findings of Howell in *Gallus*, not innervated by twig of this dorsal branch but by separate branch from base of N. dorsalis scapulae; this latter branch arises immediately distal to base of N. subcoracoideus.

M. subcoracoideus; consists of two parts, anterior and posterior, with widely separated origins and common insertion. (1) Anterior part. Origin: coracoid—oval area on dorsal surface posteriorly adjacent to glenoid facet; fibers closely adherent to ventral portion of M. subscapularis near insertion of latter. Innervation: N. subcoracoideus, anterior twig. (2) Posterior part. Origin: coracoid—inner surface of base medial to sternocoracoidal impression, with lateral margin of muscle adjacent to medial margin of impression. Innervation: N. subcoracoideus, posterior twig. The posterior part unites with the anterior part two-thirds length of coracoid anteriorly. Common insertion: humerus —tendon on margin of internal tuberosity ventrally adjacent to insertion of M. subscapularis.

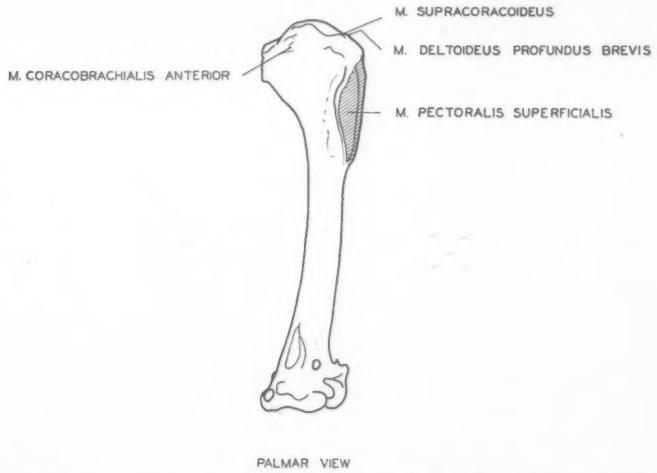

Fig. 53. Humerus of *Corvus brachyrhynchos*, x1, showing areas of muscle attachment on proximal end.

Brachio-antebrachial group.—M. triceps; made up of two distinct portions, scapulotriceps and humerotriceps. (1) Scapulotriceps (not considered since it is not directly related to morphology of head of humerus). (2) Humerotriceps; originates as two main branches, lateral and medial, with common insertion: (a) Lateral branch, composed of three digitations; ventral head—proximal portion of bicipital crest immediately lateral to M. dorsalis scapulae, extending distally around tendinous insertion of latter; medial head—from lateral (ventral) edge of pneumatic fossa, joining ventral head 2 mm. distally at posterior margin of insertion of M. dorsalis scapulae; dorsal head—from proximal wall of lateral one-half of fossa, joining united lateral and medial heads short distance distal to their union. Lateral branch attached to ventral margin of humerus from its origin distally about three-fourths length of bone; attachment consists of a few fibers on a line along which indistinct ridges may be visible. (b) Medial branch—single head from wall of shaft and posterior portion of capital groove between internal tuberosity and capital shaft ridge adjacent to head of humerus; indentation present at site of origin; few fibers attach along "line of shaft"; attachment extends three-fourths length of bone and fine lines or ridges may occur on bone. The lateral and medial branches unite one-half length of humerus distally. Insertion: ulna—by a common tendon. Innervation: N. radialis.

Pectoralis matrix.—M. pectoralis superficialis. Origin: carina—area adjacent to margin; sternal plate—narrow area along posterior margin, and a few fibers lightly adherent to posterolateral surface of sternal plate; membrane covering sternal notch—surface of membrane and posterior sternal process;

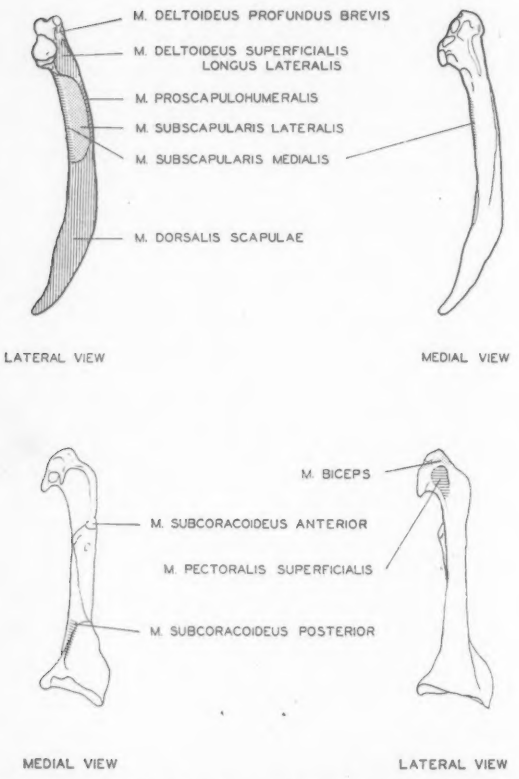

Fig. 54. Scapula (above) and coracoid (below) of *Corvus brachyrhynchos*, x1, showing areas of origin of muscles.

lateral body surface—light fascia attached from surface of ribs adjacent to posterior sternal process and from fascia of adjacent muscles; clavicle—anterior, lateral, and posterior surfaces, extending from furcular process anterodorsally one-half length of bone; dorsal to this point limited to anterior and lateral surfaces; coracoid—broad tendon from anterolateral surface of head; coracoclavicular membrane—ventral posterior portion. Insertion: humerus—pectoral surface. Innervation: N. pectoralis.

Anterior coracoid matrix.—M. supracoracoideus. Origin: ventral manubrial spine—entire lateral surface; carina—area not occupied by M. pectoralis superficialis; sternal plate—anterior surface; posterolateral boundary a line from postlabial ridge to posterior end of carina where origin of M. pectoralis superficialis reaches sternal plate. Insertion: humerus—on external tuberosity by strong tendon; scar medial to that of M. deltoideus profundus brevis. Innervation: N. supracoracoideus which arises proximally from N. 14.

Posterior coracoid matrix.—M. coracobrachialis posterior. Origin: coracoid—posterolateral surface (posterolateral crest) of ventral two-fifths; sternum, postlabial ridge—by fascia over M. sternocoracoideus (M. subclavius, Shufeldt) to postlabial ridge; to slight extent from fascia of M. sternocoracoideus. Insertion: humerus—on crest of internal tuberosity by strong tendon. Innervation: by twig arising from N. pectoralis, farther distally than in *Gallus*.

M. coracobrachialis anterior. Origin: anterior surface of dorsal ligament, which extends from head of coracoid to palmar surface of head of humerus near M. pectoralis superficialis. Insertion:

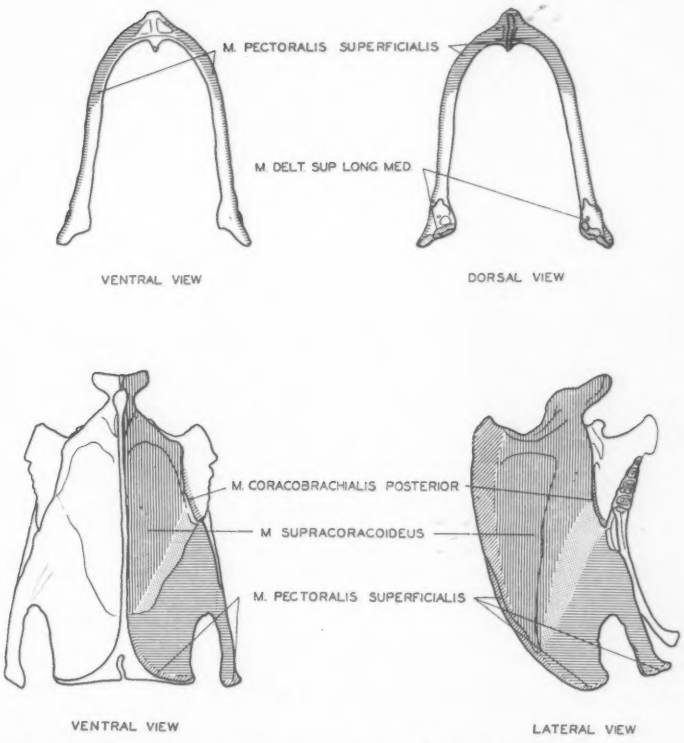

Fig. 55. Furculum (above) and sternum (below) of *Corvus brachyrhynchos*, x1, showing areas of origin of muscles.

humerus—thin fascia on palmar surface medial to dorsal ligament. Innervation: not observed. This muscle in *Corvus brachyrhynchos* is small and indistinctly defined.

Brachio-antebrachial group.—M. biceps. Origin: coracoid—lateral surface of dorsal end by broad tendon; humerus—lateral margin of pneumatic fossa by flat tendon. Insertion: ulna. Innervation: branches of common flexor nerve.

OSTEOLOGY

A comparison of the configuration of the humerus in members of the Corvidae shows the high degree of uniformity that one would expect in a family which is a natural group. When the range of individual variation is established, it is clear that the several genera, and particularly their respective species, can be distinguished from one another only by minor differences in configuration.

An attempt has been made to construct the key to the humeri of available genera and species of corvids on an absolute rather than a comparative basis. Measurements of the humerus are used as the basis for the primary divisions of the family. The various measurements are:

1. Length: the maximum length from the head to the condyles.
2. Width of head: the maximum width from the external tuberosity to the margin of the proximal portion of the bicipital crest.

3. Distal width: the maximum width between the prominences of the ectepicondyle and the entepicondyle.
4. Minimum shaft diameter: the minimum diameter measured between the surface on a line from the bicipital crest to the entepicondylar prominence and the surface on a line from the deltoid crest to the ectepicondylar prominence.

TABLE 1

Average minimum and maximum measurements of humeri of corvids in millimeters

	Number measured	Length	Width of head	Distal width	Minimum shaft diameter
Corvus corax	6	89.0 (82.1-101.7)	25.6 (23.6-27.7)	21.2 (19.0-24.7)	7.8 (6.7-8.9)
Corvus cryptoleucus	6	71.0 (68.2-73.5)	20.8 (20.2-21.6)	17.4 (17.0-17.8)	6.3 (6.0-6.8)
Corvus brachyrhynchos	25	63.6 (56.0-71.0)	17.9 (16.0-20.6)	15.9 (14.1-17.9)	5.7 (5.0-6.3)
Pica pica hudsonia	17	43.7 (41.9-47.9)	12.3 (11.8-13.4)	11.2 (10.6-12.1)	3.7 (3.5-4.3)
Pica nuttallii,	10	43.3 (41.1-44.0)	12.2 (11.3-13.0)	11.0 (10.4-11.7)	3.7 (3.5-4.2)
Nucifraga columbiana	10	38.2 (36.0-39.8)	11.5 (10.4-12.1)	10.3 (10.0-10.5)	3.4 (3.3-3.6)
Aphelocoma sieberi	4	38.5 (37.0-39.1)	11.0 (10.9-11.2)	9.9 (9.8-10.1)	3.2 (3.0-3.3)
Cyanocitta stelleri	39	34.0 (31.6-36.7)	10.2 (9.5-10.8)	8.9 (8.4-9.4)	3.0 (2.7-3.4)
Cyanocitta cristata	9	33.0 (31.9-34.7)	10.0 (9.7-10.4)	8.8 (8.5-9.2)	2.9 (2.7-3.2)
Cyanocephalus cyanocephalus	13	34.3 (32.2-35.9)	10.7 (10.3-11.2)	9.1 (8.7-9.6)	3.0 (2.8-3.3)
Aphelocoma californica	35	31.1 (28.9-33.5)	9.1 (8.2-9.7)	8.2 (7.5-8.6)	2.7 (2.4-2.9)
Perisoreus canadensis	12	30.2 (28.8-31.8)	9.0 (8.6-9.5)	7.9 (7.5-8.2)	2.6 (2.5-2.8)

Plottings of frequency distribution of measurements makes it obvious that for certain species the number of individuals used was insufficient to suggest correctly the range for the species. This situation had to be taken into account in setting limits of size groups in the key.

After a survey of the family, six features of the configuration of the head of the humerus, each of which varied among the different species, were chosen for possible use as key characters. These characters are:

1. The presence or absence, and the degree of development, if present, of a small concavity adjacent to the margin of the head of the humerus at the point of origin of the medial branch of M. triceps.
2. Configuration of the internal tuberosity at the point of tendinous insertion of M. coracobrachialis posterior: the degree of prominence of this shoulder, its shape (angular or rounded), and the curvature of its proximal margin.
3. The completeness of the fossa, and the size and shape of the fenestra. For orientation in description of the shape, this fossa was viewed from the distal end of the humerus with the internal tuberosity above it; the apex of the fenestra is thus directly below the tuberosity.
4. The deltoid crest, whether rounded or straight when viewed from anconal aspect.
5. The straightness of the capital groove, the shape of its basin and the presence or absence of a ridge at the medial end of the grove.
6. The presence or absence of a groove at the base of the medial bar (medial margin of M. proscapulohumeralis).

A summary of the development of these characters is given in table 2. The numbers in parentheses show the proportionate occurrence of the respective characters. For example, 8:10 means the "character" is present in the proportion of eight out of ten individuals.

TABLE 2

	Concavity at margin of head (origin medial branch, M. triceps)	Shelf on internal tuberosity at insertion of M. coracobrachialis posterior		
		Prominence	Shape	Margin
Corvus corax	None (10:10) Slight depression (4:10)	Distinct (10:10)	Angular	Straight proximally (8:10)
Corvus brachyrhynchos	None (10:10) Slight depression (5:10)	Distinct (6:10); Medial margin indistinct (4:10)	Angular, oval	Medially convex
Corvus cryptoleucus	None (10:10) Slight depression (2:10)	Distinct (10:10)	Angular	Medially convex
Pica pica	None (10:10)	Distinct (8:10)	Round, oval	Rounded
Pica nuttallii	None (10:10) Slight depression (6:10)	Distinct (10:10)	Angular, square	Medially indistinct, straight
Nucifraga columbiana	None (10:10)	Distinct (6:10)	Oval, angular	Proximally indistinct; slopes to internal tuberosity
Aphelocoma sieberi	Slight (10:10)	Distinct (8:8)	Oval, angular	Proximally indistinct; slopes to internal tuberosity
Cyanocitta stelleri	Slight (7:10) None (3:10)	Indistinct (9:10)	Round, oval	Proximally indistinct; slopes to internal tuberosity
Cyanocitta cristata	Prominent (2:10) Slight (6:10) None (2:10)	Indistinct (10:10)	Round, oval	Proximally indistinct; slopes to internal tuberosity
Cyanocephalus cyanocephalus	Slight (10:10)	Indistinct (10:10)	Round, oval	Proximally indistinct; slopes to internal tuberosity
Aphelocoma californica	Slight to prominent (10:10)	Distinct (10:10)	Round, oval or rounded square	Straight, round
Perisoreus canadensis	None (4:10) Slight (6:10)	Distinct	Angular at medioproximal margin	

	Fossa I		Pectoral crest	Capital groove		Groove at base of medial bar
	Completeness	Fenestra		Straightness	Ridge	
Corvus corax	Incomplete	Small; oval or chordate medially	Rounded (8:10); straight medially (2:10)	Straight (10:10)	None	None
Corvus brachyrhynchos	Incomplete	Small; oval, rectangular, triangular	Straight (6:10); slightly rounded (4:10)	Straight (2:10)	Slight, rounded (4:10)	None
Corvus cryptoleucus	Incomplete	Small; oval, or rounded square	Straight (8:10); slightly rounded (2:10)	Straight (8:10)	None	None
Pica pica	Incomplete (varies widely)	Small (5:10) to large (5:10)	Slightly rounded; medially nearly straight	Curved (10:10)	Slight (2:10)	Present (10:10)
Pica nuttallii	Incomplete (7:10), varies	Small (3:10) to large (7:10)	Slightly rounded	Curved (9:10)	Slight (2:10)	None (8:10)
Nucifraga columbiana	Incomplete	None (1:10) Small (4:10); Large, odd-shaped (5:10)	Rounded (7:10); straight (3:10)	Curved (10:10)	Slight (3:10)	Slight, obscure (3:10)
Aphelocoma sieberi	Incomplete (2:8)	Small (1:8) Large 7:8); rounded laterally, straighter medially	Straight (6:8) Concave (2:8)	Slightly curved (8:8)	None (7:8)	Slight (2:8)
Cyanocitta stelleri	Complete (10:10)	Large, round, rectangular; notch at apex (7:10)	Straight (6:10); slightly concave (2:10), slightly convex (2:10)	Straight (7:10)	Present (10:10), varies in prominence	Slight, round (4:10)
Cyanocitta cristata	Complete (8:10)	Small to large; rounded, rectangular	Straight (2:10); slightly convex (8:10)	Straight (4:10)	Present (8:10), varies in prominence	Slight, round (4:10)
Cyanocephalus cyanocephalus	Incomplete (4:10)	Small to large; notch at apex (8:10)	Straight, or nearly so (7:10)	Curved (10:10); forms groove in head (9:10)	Prominent (10:10)	Slight (4:10)
Aphelocoma californica	Complete (9:10)	Large; as wide as high	Slightly concave (7:10); straight (3:10)	Curved (9:10)	Slight (8:10)	Present (9:10)
Perisoreus canadensis	Complete (7:8)	Large, wider than high	Rounded (6:8)	Curved (10:10)	Slight to indistinct	Present (6:10)

KEY TO THE HUMERI OF CERTAIN NORTH AMERICAN CORVIDS

Only those species represented by four or more individual skeletons are included; nevertheless some of the characters in use may not prove to be valid when larger series are examined.

A. Length more than 55 mm.; shaft 5.0 mm. or more in diameter; width of head more than 15 mm.
  B. Length more than 80 mm.; width of head more than 23 mm.; distal width more than 18.5 mm. *Corvus corax*
  BB. Length less than 80 mm.; width of head 15.0-22.0 mm.; distal width 13.5-18.5 mm.
    C. Bicipital furrow distinct; surface between furrow and palmar ridge perpendicular or nearly so. *Corvus brachyrhynchos*
    CC. Bicipital furrow absent or broad and indistinct; surface between furrow and palmar ridge not perpendicular, but sloping. *Corvus cryptoleucus*
AA. Length less than 55 mm.; shaft less than 4.5 mm. in diameter; width of head less than 15 mm.
  B. Length more than 41 mm.
    C. Groove present at base of medial bar; area of insertion of M. coracobrachialis posterior not set off sharply from surface of internal tuberosity *Pica pica hudsonia*
    CC. No groove at base of medial bar; area of insertion of M. coracobrachialis set off sharply from surface of internal tuberosity. *Pica nuttallii*
  BB. Length less than 41 mm.
    C. Length 36.0 mm. or more.
      D. No concavity present at origin of medial branch of M. triceps; pneumatic fossa broadly rounded beneath internal tuberosity, angular or narrowly rounded next to shaft surface, and rounded laterally. *Nucifraga columbiana*
      DD. Concavity present at origin of medial branch of M. triceps (if no concavity distal width less than 10.0 mm.); fossa angular or narrowly rounded beneath internal tuberosity, broadly rounded next to shaft surface, and straight laterally.
        E. Length of deltoid surface more than 4.5 times its width, length of bone 37.0 mm. or more, distal width more than 9.5 mm. *Aphelocoma sieberi*
        EE. Length of deltoid surface less than 4.5 times its width, length of bone less than 37.0 mm.; distal width less than 9.5 mm. *Cyanocitta stelleri*
    CC. Length less than 36.0 mm.
      D. Distance from plane of bicipital surface to anconal apex of internal tuberosity more than 4.5 mm.
        E. Distal end of palmar ridge (palmar aspect) parallel to pectoral crest, or approaches apex of pectoral crest at low angle (usually less than 25 degrees at point of juncture). *Cyanocitta stelleri*
        EE. Distal end of pectoral ridge not parallel to pectoral crest, approaching apex at high angle (usually more than 25 degrees at point of juncture).
          F. Bicipital margin of floor of fossa with acute ridge, not rounded; medial bar relatively straight in anconal view. *Cyanocitta cristata*
          FF. Bicipital margin of floor of fossa with rounded ridge, not acute; medial bar concave distally in anconal view. *Cyanocephalus cyanocephalus*
      DD. Distance from plane of bicipital surface to anconal aspect of internal tuberosity less than 4.5 mm.
        E. Pneumatic foramen rounded, as wide as high. *Aphelocoma californica*
        EE. Pneumatic foramen compressed, wider than high. *Perisoreus canadensis*

DISCUSSION

In the course of the study of the Corvidae, other passerine families were examined with a view to determining the general limits of variation of the fossae of the head of the humerus within the Passeriformes. In addition, the "lower" orders of Aves were surveyed superficially in an attempt to ascertain "primitive" and "advanced" conditions of the fossae.

In all groups of birds, except a part of the passerines, only one fossa is present. As one examines the orders in the sequence set forth in the A. O. U. Check-list (1931), a tendency toward an increase in size and depth of this single fossa (Fossa I) is readily apparent. This general tendency toward enlargement, as one proceeds from the primi-

tive to the advanced orders, indicates that the M. humerotriceps becomes progressively more important functionally, since its diameter is reflected in the size and depth of the fossa. In the following discussion of the passerines the term "primitive" is used to refer to the part of the order that is similar to the lower orders of birds in that only Fossa I is present in the head of the humerus. Since both Fossa I and II are present only in a part of the Passeriformes, and since Fossa II is present only in those passerines capable of vertical flight, this latter part of the order is considered to be "advanced."

In the primitive group of passerines which have but one fossa (Fossa I), the fossa varies from shallow and incomplete to deep and complete. In some of the more advanced families of the "primitive group" a concavity occurs medial to Fossa I, but the proximal wall of this concavity is thick and not translucent as in the "advanced group." All of the members of the "advanced group" have both Fossa I and II present. In the lower families of the advanced group Fossa II is small and completely separated from Fossa I by the medial bar. This bar is shortened in the higher families so that it does not extend distally into the floor of the fossae; thus I and II are united. With the reduction of the medial bar there occurs an increase in the thickness of the crista of the head; apparently this thickening is to maintain rigidity.

The degree of completeness of Fossa II is correlated with the area of cross section of the medial branch of M. humerotriceps. In the Corvidae and other passerine families of the "primitive group" this branch is smaller than the lateral branch and is usually less than one-third the diameter of the latter. In the "advanced group" the medial branch varies from one-half to approximately the same diameter as the lateral branch. The maximum development of the medial branch is present in the fringillids. In this family of passerines vertical flight is most highly developed. The exact role that the M. humerotriceps plays in vertical flight is not clear at the present writing, but since the muscle is the only extensor of the elbow joint, its increase in size and length obviously results in an increase in the ability of the individual to extend the outer wing. This increase in the speed and strength of the extension is apparently correlated with vertical flight. The wing is semiflexed at the beginning of the down stroke and the extension of the outer wing is reached at the termination of the down stroke. A rapid and forceful extension near the completion of the stroke, accompanied with rotation of the humerus, may aid the outer wing muscles to snap the hand and finger portions of the wing downward. Rotation of the humerus is necessary when a bird leaves its perch and flies directly upward with its body axis in a vertical direction. The recovery is made with the wing in a semiflexed position. The afore-mentioned rotation is mainly the result of the action of Mm. pectoralis superficialis, dorsalis scapulae and proscapulohumeralis.

It is of interest to note that the presence of the medial fossa (Fossa II) transfers the line of stress from an oblique direction in relation to the line of the shaft of the humerus to a position parallel to the line.

Such families as the Tyrannidae, Alaudidae, Cotingidae, Corvidae, and the divergent Hirundinidae fall into the "primitive group," while in the "advanced group" the Fringillidae, Thraupidae, Icteridae, Ploceidae, and Compsothlypidae occur. Some genera of the Mimidae are "primitive," others "advanced," with respect to the humerus. It is of interest to note that in young individuals of *Agelaius phoeniceus* there is but one fossa present (Fossa I), whereas in the adult both Fossa I and II have developed.

Obviously it is not possible to establish a "phylogenetic series" within the family Corvidae based on a single character. It seems advisable, however, to note the relationships as suggested by the characters of the head of the humerus so that future workers may compare their interpretations derived from other characters.

A shallow pneumatic fossa (Fossa I) with no concavity or depression at the margin of the head (origin of the medial branch of M. triceps) is considered to be generalized. In the more specialized condition the pneumatic foramen is deep, and a concavity occurs near the margin of the head at the point of origin of the medial branch of M. triceps.

Based only on the characters of the head of the humerus and primarily on the degree of development of the pneumatic fossa, the order of the members of the family from generalized toward specialized is:

Corvus corax. Raven.
Corvus cryptoleucus. White-necked Raven.
Corvus brachyrhynchos. American Crow.
Pica pica hudsonia. American Magpie.
Pica nuttallii. Yellow-billed Magpie.
Nucifraga columbiana. Clark Nutcracker.
Cyanocephalus cyanocephalus. Pinyon Jay.
Cyanocitta cristata. Blue-jay.
Cyanocitta stelleri. Steller Jay.
Aphelocoma sieberi. Arizona Jay.
Aphelocoma californica. California Jay.
Perisoreus canadensis. Canada Jay.

The relationship between the genera is diagrammed in figure 56. The point at which the branch terminating in *Cyanocephalus*, *Cyanocitta*, and *Aphelocoma* arises may

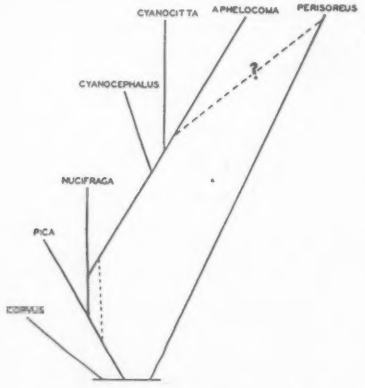

Fig. 56. Diagram showing relationship of certain genera of corvids based on configuration of head of humerus.

well be placed too far from the base of this limb, but the affinities are toward *Nucifraga*. The relationship of *Perisoreus* is uncertain as indicated, but its humeral similarity to *Aphelocoma* is clear.

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Museum of Vertebrate Zoology, Berkeley, California, January 25, 1941.

FROM FIELD AND STUDY

The Directive Sense in Migrant Birds.—On May 14, 1932, our party was proceeding southeastward by motor boat from Santa Barbara, California, toward Anacapa Island. Heavy fog blanketed us almost to the sea surface. All at once a female Black-throated Gray Warbler (*Dendroica nigrescens*) was among us on the launch. It was quite unafraid as it hunted about the superstructure for insect food, allowing a hand to be cupped about it to move it out into the open for better photography. It soon became uneasy, however. The direction we were going was wrong. It launched out over the sea surface directly to the rear (west of north), then lost courage in the fog and returned to us. After a brief period it again felt the urge and flew astern, again lost courage and fluttered back to rest on the skiff which we were towing on a long painter. From there it once more returned to the larger "floating island" to repeat its search for food. Soon we came into the cove at the east end of Anacapa and the cliffs appeared through the fog only a few yards away. Seeing this land mass, the warbler flew up and disappeared among the stunted vegetation. The northward urge seemingly had been overcome by the desire for security and the island won the toss. The plumage of the bird was not in perfect condition, which circumstance suggested a bodily weakness that perhaps increased the timidity and at the same time diminished the migratory urge. The directive sense was, however, unimpaired. This species moves northward through the lowlands of southern California in great hordes, the females especially being as late as May 5 to 15. Our subnormal individual might easily have been even more retarded than the average female.

This case remained buried in my notebook as exceptional until this spring when two corroborative experiments were unwittingly performed on another transient species.

On May 12, 1941, two birds identified as Lincoln Sparrows (*Melospiza lincolnii*) were live-trapped by Mr. Palmer Stoddard in Beverly Hills, California, and brought to me for examination. The birds had been transported several miles in cages covered by dark cloth. After examination they were liberated from an inset balcony that faces southeast. The hour was 7 p.m. and the sun had been down some minutes. The direct avenue of escape was to the southeast and the first bird liberated took that line in frantic haste. However, at about thirty yards distance it swung sharply through a complete reversal and rose over the house into the evening sky heading northwest. The second bird was then removed and examined. When liberated it burst forth on a line only very slightly to the south of the other bird's course. At almost exactly the same distance from the starting point it made the same turn to the northwest and climbed into the sky on its proper course. There was shrubbery on either side of the balcony and deep cover across the street, just such cover as Lincoln Sparrows frequent, but no attempt was made to hide therein.

This species migrates through the Los Angeles area as a vernal transient, hiding by day in weed patches or low shrubbery. I suspect that these two individuals would have normally taken off soon for a night flight to their next stopping place. The striking thing was to see the "automatic steering gear" apparently operate so quickly to bring a badly frightened bird back upon its charted course, the air way of its race followed by untold generations of its ancestors.

It is not necessary here to hypothesize a guiding agency that is supernatural but merely one that is superhuman. There are many ways in which the bird is superhuman (or perhaps better, in which we are subavian).—Loye Miller, *University of California, Los Angeles, May 16, 1941.*

White-headed Woodpecker at Pasadena, California.—On April 23, 1941, while looking for robin nests along the Arroyo Seco in Pasadena, California, near the South Pasadena line, a White-headed Woodpecker (*Dryobates albolarvatus*) attracted my attention by knocking off a chip which in falling narrowly missed my head. Although there were numerous conifers in the immediate vicinity, the bird was in one of a series of live oaks which bordered South Arroyo Boulevard. The bird, a fine male, soon flew to a dead live oak standing alone in a large lawn across the street, where I watched it for some twenty minutes. Pebbles and mud-balls thrown from distances varying between twenty and thirty feet failed to flush the bird. The bursting mud-balls merely caused the woodpecker to move around to the other side of whatever limb he was drilling on at the moment. Ultimately he flew back to a spot in the live oaks near the one in which I had originally discovered him. The bird was not seen again until May 1. It was seen for the last time on May 5. This record is of interest in that this species is rarely found outside its normal habitat in the mountains, and there seems to be no previous record for this low level in the Pasadena area.—Wendell Taber, *Pasadena, California, May 5, 1941.*

Shrike Feeding on a Cave Bat.—On August 15, 1937, as the writer and two companions entered a mine tunnel in eastern Riverside County, California, in search of bats, we were surprised to encounter a Loggerhead Shrike (*Lanius ludovicianus*) twenty feet within the portal of the tunnel. While birds are often found roosting in the shade of mine tunnel portals, they seldom venture more than five or ten feet within.

The shrike had evidently not noticed our approach, as it did not take flight from the floor of the tunnel until we were ten feet within the tunnel. Taking flight, the bird darted out of the tunnel and alighted on a creosote bush overhanging the open cut in front of the portal. After making certain of the identification of the bird, the tunnel was entered to the point where the shrike had risen from the floor, in order to determine, if possible, what had caused the bird to enter to such a depth.

Upon reaching that point, the beam from a hand lamp revealed the half-eaten body of a cave bat (*Myotis velifer velifer*), a species known to inhabit this particular tunnel. It was evident that the bat was freshly killed, as the blood was uncoagulated and the remaining portion of the body was still quite warm. Blood was also present in wet smears upon the surface of the rock on which the half-eaten bat lay. How the shrike captured the bat remains unknown.—KENNETH E. STAGER, *Los Angeles, California, February 26, 1941.*

Starlings in the Lower Rio Grande Valley of New Mexico.—On January 15, 1941, at about 10:00 a.m., a small flock of European Starlings (*Sturnus vulgaris*) was observed foraging in a cornfield near old Fort Fillmore, seven miles southwest of Las Cruces, Dona Ana County, New Mexico, in the Rio Grande valley.

The starlings were foraging with White-necked Ravens, Crows, and Yellow-headed Blackbirds. Three of the starlings were taken, two females and one male. A specimen was made of the male bird and placed in the collection of the New Mexico State College, State College, New Mexico.

This is the second record of starlings in the Rio Grande valley of New Mexico. Their first appearance in the valley was reported in 1939, near Albuquerque, almost 250 miles north of Las Cruces (Borell, Condor, 42, 1940:86).—LEVON LEE, *State College, New Mexico, April 7, 1941.*

The Loon as a Duck Killer.—Any reliable observer who has had experience in the field where loons come in contact with nesting ducks must be impressed by the terror displayed by ducks whenever a loon invades their territory. But the actual destruction of ducks or ducklings is hard to prove. Although dead waterfowl of many species, practically all of tender age, may be picked up, the wounds that produced death might have been inflicted by other birds or mammals. Only in one instance have I heard of ducklings being used as food by loons. In the January, 1941, number of the Ibis an extremely interesting article, "August in Shetland", by Col. R. Meinertzhagen, after detailing the damage done to eider broods and adult eiders by the abundant Greater Skuas, damage which resulted in the total destruction of all the eider broods observed, goes on to relate a definite case of a loon devouring a young eider (p. 110): "On a third occasion a most remarkable instance of combined air and naval action was witnessed against a duck accompanied by three ducklings. A single Skua commenced his tactics of swoop and grab, and whilst this was taking place I noticed a Great Northern Diver swimming towards the scene from about 150 yards distant. He soon submerged, and surfaced near the terrified Eider mother with a duckling in his bill. This was swallowed, and by this time the Skua had sufficiently exhausted a second duckling to strike it dead. The Skua settled and commenced its meal. The third duckling never reappeared, and the disconsolate mother, who had witnessed the baby killers' frightfulness, swam around, in a truly pathetic manner, seeking her ducklings which were not. A local crofter who took an interest in birds informed me that the Immer or Ember Goose, a Norse name by which the Great Northern Diver is known, comes down from the north towards the end of July every year and takes a heavy toll of young Eiders, even more so than do the Skuas. In all we saw four pairs of these Divers near our coast."

The Great Northern Diver is of course the same bird as our Common Loon (*Gavia immer*), and when it is remembered that for one of these birds in eastern North America or Europe we have at least fifty in western North America some idea of the possible damage may be realized. Also the smaller species of loons, especially the forms of *Gavia arctica*, are just as pugnacious in the nesting season and few people realize the incredible numbers of these loons in the Pacific and western Arctic regions of this continent.—ALLAN BROOKS, *Comox, British Columbia, March 31, 1941.*

A Note on the Food of Burrowing Owls.—Several recent notes on the food of the Burrowing Owl (*Speotyto cunicularia*) lead me to report on the debris found at the mouth of an owl den observed several years ago. In April, May, and June, 1932, I frequently passed by an inhabited den in a canal

bank some ten miles northeast of Maxwell, Colusa County, California. During June the cattails in the canal were occupied by a moderate-sized colony of Tricolored Red-wings (*Agelaius tricolor*), and adjoining the canal was a large rice field which was rather heavily populated by nesting Black Terns (*Chlidonias nigra*).

Passing by this den on July 15, 1932, I noted a large quantity of feathers and stopped the car to investigate. The following debris was listed: 64 wings of nestling Black Terns, 16 wings of juvenal Tricolored Red-wings, about 10 inches of the vertebral column of a small snake, 1 pocket gopher skull, 2 giant water beetles (*Hydrous triangularis*), and remains of 1 scorpion (see fig. 57).

Fig. 57. Remains of birds eaten by a family of Burrowing Owls.

It seems quite apparent that this family of owls were opportunists and that much of their food during June was composed of juvenal blackbirds and terns taken from nests within a few yards of the den. Some few young of both species were still in their nests on July 15.

Passing this way fully a month later, I again stopped to inspect the den and found that the current food remains consisted entirely of pellets of beetle fragments, normal food of the species in this area.—Johnson A. Neff, *Fish and Wildlife Service, Denver, Colorado, May 1, 1941.*

A Record of the Northern Flicker in Butte County, California.—Mr. Allan Coon of Durham, Butte County, California, shot two flickers which were drilling holes in his house on a farm two miles west of Durham on November 20, 1940. One was a typical Red-shafted Flicker, *Colaptes cafer collaris*; the second bird was slightly smaller, and the shafts and under sides of the wings and tail were bright yellow. The skin of this second bird has been identified by Dr. Alden H. Miller of the Museum of Vertebrate Zoology as that of a typical Northern Flicker, *Colaptes auratus luteus*; it is now in the collection of Chico State College at Chico, California.—E. G. England, *Durham, California, January 12, 1941.*

Foraging Behavior in the Western Bluebird.—A loose flock of about ten Western Bluebirds (*Sialia mexicana*) and a Say Phoebe (*Sayornis saya*) was observed feeding on a south-facing, open, grassy slope opposite (north of) St. Mary's College, Moraga Valley, Contra Costa County, on March 1, 1941. A strong southwest wind was blowing with consequent strong up-drafts passing along slopes and through the open draws. The birds were perched on dried weed stalks and fence posts, generally facing the wind. The Say Phoebe remained in the same vicinity, apparently indifferent to the bluebirds nearby. The bluebirds would fly to a position in the up-draft some 6 to 8 feet above the ground, there hover for a second or two, and then soar for a few seconds. On a number of occasions, one or two of them remained in a soaring position without movement of wings for 6 to 8 seconds (fig. 58).

The birds were foraging for insects, which they caught by dropping quickly from their position in the air. It appeared that the wind was blowing insects upward over the hill slightly above the grass. The bluebirds, hovering or soaring and looking down, watched for them; when prey was sighted, the bird turned about face and flew back to catch up with it. Such a behavior was observed on both the open slopes and in the draws. As many as four birds were noted hovering and soaring at one time over a few square yards of area. In the draws, soaring was not as prolonged as on the more exposed faces; in the former situations, the bluebirds alternately hovered and soared a few seconds each before dropping for prey. The Say Phoebe behaved similarly except that it did not soar but merely hovered. In the Mountain Bluebird (*Sialia currucoides*), hovering is a characteristic trait (Grinnell and Storer, Animal Life in the Yosemite, 1924:625).

Fig. 58. Soaring position of the Western Bluebird. The arrow indicates the general direction of the wind with reference to the horizon.

Western Bluebirds may often be noted to hover in hunting for food, but the observation here reported presents evidence for the substitution of soaring for hovering under suitable air conditions. Among passerines, soaring of course seldom occurs.—FRANK A. PITELKA, *Museum of Vertebrate Zoology, Berkeley, California, May 17, 1941.*

A Condor in the San Jacinto Mountains, California.—On January 15, 1941, while in the San Jacinto Mountains, Riverside County, California, Mr. William E. Bullard and I observed what we believe to have been a California Condor (*Gymnogyps californianus*). The bird was circling around above Fobes Ranch, which is in the middle of the area burned by the Garner fire in 1940, and about ten miles in an airline southeast of San Jacinto Peak. The condor was trying to dodge the attacks of a large reddish-brown hawklike bird. After about a minute, the birds disappeared over a ridge. The condor was identified by its buzzard-like shape and two definite white areas, one under each wing. The birds were so far above us that we could not observe any positive identifying marks on the attacker, but from the observations of others we judge that this was most likely a Golden Eagle.

A dead cow was lying on the hillside above the Fobes Ranch. It was bloated and a portion of the carcass beneath the tail had been eaten away. It is possible that the condor had been eating on the cow carcass when discovered and chased away by the eagle.

A few weeks later, the appearance of a huge bird a few miles southeast of Hemet was reported by some people who believed it might be a condor. Since then we have heard of no reports of birds which might be condors in the San Jacinto Mountains. It is thought that the bird observed was a visitor rather than a permanent resident.—RICHARD H. MAY, *Riverside, California, April 6, 1941.*

The Black Merlin in Southern California.—The Black Merlin (*Falco columbarius suckleyi*) was recorded as a straggler in southern California by Willett in 1912 (Pac. Coast Avif. No. 7, 1912:49). The single specimen he records was taken at Claremont, California, on December 6, 1895, by J. F. Illingworth, and it is now in the Grinnell Collection at the Museum of Vertebrate Zoology in Berkeley. No subsequent specimen from south of the Tehachapi has been placed on record so far as I can discover. The object of this note is to extend the list of such specimens.

On March 5, 1939, a fully adult male was picked up wounded and brought to Mrs. Myrtle S. Edwards of Claremont, who recognized its importance. The bird died the following day and was prepared by Mr. Karl Kenyon of Pomona College. Mrs. Edwards generously presented it to the University of California at Los Angeles. The specimen is in beautiful plumage. The bluish slate of the dorsal surface becomes smoky black on the hind neck due to suffusion by the brown pigment of the neck ring. The bluish slate of the crown is rendered still darker by the relatively broader black median penciling on each feather. The light brown of the supra- and post-orbital stripe is almost entirely lost. On the ventral surface the black central feather stripes are greatly expanded even down to the tibial flags and crissum which are broadly marked and show but little brown pigment.

The brown wash across the chest is almost entirely lacking and such as appears on the tibial flags is quite a dark chestnut as compared with a high-plumaged winter male of *F. c. bendirei*. Tail bars are narrower and much darker blue, with the terminal band almost obsolete.

The second specimen ascribed to this race (or this color phase; see Swarth, Condor, 37, 1935:201) is a female from Pasadena. This bird also was picked up about December 1, 1940, alive, but badly wounded, and brought to the home of Harold Michener. It was later prepared as a skin by myself. The ovaries showed evidence of having been active the previous spring, but the general plumage is that of an immature bird. One feather of the left scapular area, however, shows the dark blue with central black stripe of the mature plumage. As compared with another post-breeding winter female from San Fernando, Los Angeles County, the remainder of the dorsal plumage is markedly darker, with the same widening of the dark penciling on the crown. On the ventral surface, the lighter brown of the feather margins is crowded to a minimum by the heavy umber stripes down the centers. The two specimens make a very handsome pair of dark-plumed birds, the first recorded from the San Diegan district since the Grinnell specimen of more than forty years ago. The southern California birds are not from a breeding area, of course, and hence they shed no light upon Swarth's very proper suggestion of dichromatism instead of racial distinction based upon geographic range.—Loye Miller, *University of California, Los Angeles, March 3, 1941.*

Cackling Goose and Sheep.—At Qualicum Beach, Vancouver Island, British Columbia, sometime in October, 1940, a Cackling Goose (*Branta canadensis minima*), believed to be a male, alighted beside a flock of a dozen or so sheep and subsequently remained with them at all times for a period exceeding six months. The precise locality was the Qualicum golf course which slopes to the sea and is a warm and pleasant winter pasturage. The goose remained with the sheep all winter, grazing and

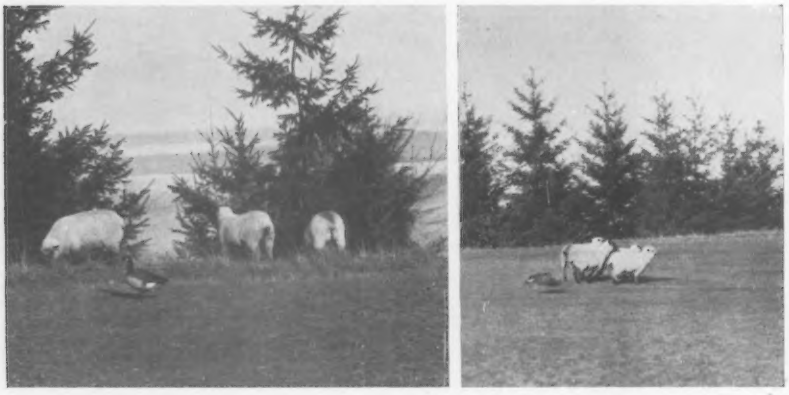

Fig. 59. Cackling Goose and part of the band of sheep with which it wintered.

resting with them by day and being folded with them at night. On the one occasion I visited the scene the goose was more fearless than the sheep. When I approached with a camera the goose continued to graze while the sheep ran. After a moment or so the goose would either run or fly after them, sometimes alighting in the midst of the flock. The goose left on the night of April 30, 1941; on the preceding day it was reported to have been restless and to have made short flights about the golf course.—J. A. Munro, *Okanagan Landing, British Columbia, May 17, 1941.*

Male Marsh Hawks at the Nest.—On May 18, 1940, while observing the nest of a Marsh Hawk (*Circus hudsonius*) in the Truckee Meadows, two miles southeast of Reno, Nevada, we were surprised to see the male fly in and alight on the nest when the female was out hunting. The bird appeared to be inspecting the four eggs, but flew up almost immediately at the sound of the camera shutter from within the adjacent blind.

Nearly a month later, on June 13, Christensen saw a male bird come to another nest with a large headless leopard lizard (*Crotaphytus wislizenii*) in his talons. He dropped the lizard and immediately flew off. This nest, located a mile east of the one first mentioned, contained three young birds thirteen days old. The female hawk was shading the young over in one corner of the low, water-surrounded

structure, but immediately came over and tore off the tail of the lizard, which she ate. Following this, she dismembered the rest of the lizard and fed it to the young, who had followed her over to the food.—GLEN CHRISTENSEN AND THOMAS TRELEASE, *Reno, Nevada, February 8, 1941.*

Range of the Texas Woodpecker in Colorado.—Literature relating to the distribution of the Texas Woodpecker (*Dryobates scalaris*) in Colorado has defined its range as being south of the Arkansas River, generally below the 5000-foot contour, and in particular confined to the extensive pinyon and cedar association below this limit. Since several standard texts (A. O. U. Check-list, 1931, and others) have accepted these limits, five records from north of the Arkansas, where the pinyon association is represented chiefly by scattered stands in arid localities, seem worthy of mention.

Sclater, in his "Birds of Colorado" (1912:227), states that "recently Aiken has received examples . . . taken in the Fountain Valley some twenty miles north of Pueblo." Pueblo is on the Arkansas, at 4600 feet elevation; the Fountain Valley is entirely a region of cottonwoods, with few pinyons anywhere. Aiken also saw one in lower Colorado Springs, September 1, 1915. During the winter of 1931-1932 a single Texas Woodpecker was present in Colorado Springs at the feeding tray of Miss Mary Avery, an observant bird lover, who made a careful identification. Colorado Springs is 45 miles north of Pueblo, at 6000 feet altitude, and literally at the upper margin of the Upper Sonoran Zone.

Three records for *scalaris* have been obtained by the writer in the past fifteen months. A female was present at the Johnson Reservoir, just east of Fountain Creek, eleven miles south of Colorado Springs, between February 10 and March 23, 1940. This was in a cottonwood association. Another winter occurrence was noted December 23, 1940, in the lower foothill (lower Transition) zone, during the Christmas census count. This bird, a male, was observed in a cottonwood grove beside Cheyenne Creek. Finally, a female was seen and carefully studied in a choke-cherry thicket near lower Colorado Springs, on May 3, 1941.

It seems possible, from these notes, that the range of the Texas Woodpecker is extending northward in Colorado beyond its formerly well-defined boundaries in the cedar and pinyon country. While so far the advance has been relatively small in distance (45 miles), students of Colorado's complex life-zone problem will recognize that these movements, reaching nearly 1400 feet greater altitude beyond the strongholds of the cedar and pinyon association, have breached one of the best-defined zones in the state.—SAMUEL W. GADD, *Colorado Springs, Colorado, May 8, 1941.*

Western Robin Nesting Near Pasadena, California.—Inasmuch as Mr. George Willett advises he has received no record of Western Robins (*Turdus migratorius propinquus*) nesting at a low elevation in the San Gabriel Valley, California, since the report by Wilson and Campbell (Condor, 33, 1931:250) of young at Monrovia, in June of 1931, it seems well to record the breeding of several pairs this spring (1941) in the Pasadena area. Prior to this year, there seem to have been no records of nests and only two records of young birds observed in the foothill region of southern California below an altitude of 5000 feet (Willett, Pac. Coast Avif. No. 21, 1933:130.).

On April 1, a pair of these birds was flying about a new lawn owned by us in Flintridge. The birds carried nesting material to a square metal ornament, which flares out at the top of a water spout immediately under the eaves of the north side of the garage. This is almost directly over the parking area, into which cars have been passing daily for months. The birds are obviously much tamer than the migrating robins, which normally roost during migration in the tops of near-by poplars. By April 15 both birds had become so used to people that they would fly from the nest down to the lawn, gathering worms within a few feet of persons playing croquet. The building of the nest seemed to occupy the birds in a desultory fashion for a number of days.

It was not until about April 30 that the parents were observed feeding young. Although the male helped with the feeding, the female invariably brooded the young at night. By May 6 it became apparent the parent birds were going farther afield to obtain worms, disappearing into the arroyo on the west, where the ground is wet nightly by an automatic sprinkler and kept damp by the thick tree-growth. Lack of rain for about ten days had rendered the ground on the lawn hard and had driven the worms well below the surface. On May 13 the nest contained three young birds, approximately one-third grown.

Four other nests have been found in the vicinity of Pasadena this year. My friend, Wendell Taber, reported about the middle of April that he had observed robins near South Arroyo Drive, and later he prepared a memorandum dated April 29, from which I quote the following: "Saw a robin taking mud out of gutter in South Arroyo Drive, Pasadena, opposite end of South San Rafael Street bridge. I saw nest with bird molding it by squatting and moving around. The nest is about

twenty feet above the ground and is made most conspicuous by having what is apparently a paper napkin inserted near the bottom in such a way that perhaps two-thirds of the napkin projects and moves with the wind."

On the same day, he discovered another pair of robins only a few hundred yards from the first pair and observed one of the birds carrying nesting material. The nest was discovered on May 13 and on May 10 Mrs. Lawrence Kiplinger of Busch Place, Pasadena, showed Mr. Taber two more occupied nests of robins not far from her property, in the Arroyo. Mrs. Kiplinger states that the robins nested in this locality in the years 1939 and 1940.

A satisfactory theory as to the underlying cause which has prompted robins to nest at the low altitude of Pasadena (700 to 1200 feet) may be found in the heavy rains of the past two years. The normal annual rainfall for the Pasadena area is 19.87 inches, but for the season of 1941 to date it amounts to 46.29 inches! Frequent rains continued throughout the latter part of March and April, keeping the ground damp and worms close to the ground surface. In fact, they were observed frequently crawling on the driveway of a near-by house. The dryness of the soil in normal years makes the obtaining of worms a problem and probably is an important factor in restricting nesting to high altitudes, where rains are more frequent.

However, it should be noted that several species of birds, normally restricted to the higher mountains, such as the White-headed Woodpecker (see p. 196) and the Blue-fronted Jays have been observed in the Pasadena area this spring. Various reports have come to me of Blue-fronted Jays staying late in April at low levels, and a pair remained on our property in Flintridge at least until April 20. For a long time there were two pairs, but only one remained through April. These individuals went through all the secretive peering actions common to birds hunting for nesting sites. As I was not well during this period, I could not definitely determine whether a nest was built. They have not been observed since May 4.—ROBERT T. MOORE, *Pasadena, California, May 19, 1941.*

Yellow-headed Blackbird Nests near Minden, Nevada.—Near Minden, Douglas County, Nevada, where a branch of the Carson River spreads into a marsh, there is a colony of Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) nesting. The area that I have been particularly interested in is a farm where cattle, sheep and pigs are kept. There are ditches bordering cultivated fields and meadow land where in the spring open water stands. From this farm the east wall of the Sierra, with snow on the upper portion, seems very close. A slight rise of ground toward the hills puts one immediately into sagebrush country.

In an attempt to find out how many Yellow-heads were nesting in what seemed to be a large and rather spread out colony, I chose for study a small patch of tules that was accessible (with the aid of high rubber boots) and where in several seasons I had seen full-plumaged males perched and singing. On May 31, 1941, I examined this patch of tules, which was approximately 20 feet long and perhaps 10 feet wide through its thickest part. I counted thirty-one nests. Ten nests had four young that had been recently hatched; one nest had one egg and three young; two nests contained three eggs only; eleven nests had four eggs each. The rest of the nests were empty. Some seemed to be new and waiting for occupancy; the others were old and disheveled. In one instance, two nests containing four eggs each were less than eighteen inches apart.

There were other nests in tules bordering the deeper open water of the marsh and some of them I saw from a boat, but did not count. Across the highway where the marsh is completely overgrown, full-plumaged males sat in the tules or other vegetation and sang and females were seen in and about the area. This was also true along some of the ditches.

I have no idea of the size of the colony but it seems to me it must number in the hundreds. —HOPE M. GLADDING, *Berkeley, California, June 16, 1941.*

NOTES AND NEWS

Westerners are again privileged in having the meetings of the American Ornithologists' Union close to home. This year the Union meets in Denver, Colorado, September 1 to 4. The sessions will be held at the Colorado Museum of Natural History. Headquarters will be at the Cosmopolitan Hotel, Broadway and 18th St. Promise of field trips to the high mountains and to the prairies should appeal to ornithologists unacquainted with the Denver region. Inquiries concerning the meeting may be addressed to Alfred M. Bailey, Chairman of the Local Committee, at the Colorado Museum.—A.H.M.

Mr. A. C. Bent, author of the series of bulletins on the life history of North American birds, writes as follows about the progress of his work:

"The fourteenth volume, on flycatchers, larks and swallows, will go to the printer very soon, though it may not be published before some time early next year, as the Government Printing Office is overcrowded.

"My work on the fifteenth volume, containing the Corvidae and Paridae, is now all written and will go to the publishers in the fall.

"I am now starting work on the sixteenth volume, to contain the birds on the 1931 Check-list from the Sittidae to the Troglodytidae, inclusive. I should be glad to receive, as soon as possible, any notes, data or photographs relating to any of the birds in these five families.

"The sooner these are sent to me, the more likely they are to be included in the work, and the more conveniently I can handle them.

"I wish to thank all former contributors to this co-operative work for the valuable material sent to me in the past, and to solicit their help in the future. All material is welcome, though I can use only the most important part of it."

Carl Koford, Audubon Research Fellow, who has been studying the natural history of the California Condor, recently was called to service with the United States Navy. All of his records and findings, which are remarkably extensive, are in safe keeping pending his resumption of the work. This unfortunate, though necessary, interruption will be keenly regretted by all ornithologists interested in Koford and the condors.

The Donald R. Dickey collection of birds and mammals which was donated to the University of California at Los Angeles last fall, has been installed in temporary quarters provided by the University at the Clark Library, 2205 West Adams Street, Los Angeles. During the past spring Mr. A. J. van Rossem, curator in charge, has been occupied with putting the collections in working condition and has resumed his taxonomic studies of Sonoran birds.

Fig. 60. E. Lowell Sumner, Jr., President of the Northern Division of the Cooper Ornithological Club; author of important papers on the California Quail and on the development of young raptorial birds.

Thoughtful comments on conservation are contained in W. L. McAtee's introduction to a paper on the "Wildlife of the Atlantic Coast Salt Marshes" (U. S. Dept. Interior, Fish and Wildlife Service, Wildlife Circular 11, 1941). Some excerpts follow: "Conservation means different things to different people. Some think of protecting only things that can be used, and here again there is more than one school of thought —or at least, of action: One protects only to the date of use and takes what it wishes without planning for replacement—this has been compared to mining; the other strives for replacement, so that there can be sustained use—this has been compared to crop production. There is also protection for beneficial economic tendencies, without direct use—this principle underlying the protection of insectivorous birds. Finally there is conservation for its own sake, the goal of the nature lover.

"Whatever his particular interest in wildlife may be, the nature lover is one who, consciously or not, is impressed with the fellowship of all

living things, a fellowship that is very real. He sees that in structure, in habits, and in impulses, his wild neighbors often seem much like himself.

"It should never be forgotten that they share with man also the joy of living. No man can possibly get as much pleasure from water as does a porpoise or an otter. However perfect his equipment, man can never be attuned to flying like the terns, the swallows, and other birds whose pliant grace, in calm or storm, is marvelous....

"That wildlife enjoys living in general as much as man, and probably in many ways even more, is a thought that should never be entirely out of mind. Man assumes dominion over wildlife and exercises it as he can, but in so doing he should as far as possible in the case of every creature respect its right to existence, to its chosen home, and to undisturbed enjoyment of its way of life. As has been so often, but not too often, said, in following out ideas for readjusting wildlife and its environment, man should do only what is necessary and no more."

The Boston Society of Natural History announces that original unpublished essays on any subject in the field of ornithology are eligible for the Walker Prize competition for 1942. For details apply to the Secretary, 234 Berkeley St., Boston, Massachusetts, after August 15, 1941. Manuscripts are due on May 1, 1942.

Announcement is made by the Cleveland Museum of Natural History that Dr. Harry C. Oberholser has accepted the position as Curator of the Ornithology Department of that museum. Dr. Oberholser has been consultant to the department for some time and now upon his retirement from the Fish and Wildlife Service takes up the position formerly held by Dr. John W. Aldrich, who joined the wildlife service in Washington.

PUBLICATIONS REVIEWED

Roger Tory Peterson's "A Field Guide to Western Birds" (Houghton Mifflin Company, Boston; May, 1941; xviii+240 pp., 42 pls. in black and white, 5 col. pls. + col. frontispiece, 40 figs. in text) accomplishes three noteworthy things which should place it high in the esteem of ornithologists of the western states. First, it covers the Rocky Mountain region and the southwestern deserts which were not included in Hoffmann's excellent handbook. Thus is brought into compact form the treatment of all birds of the United States west of the Great Plains (included are the western edge of the plains and the Rio Grande Valley of Texas). The second feature is the extension of Peterson's series of black and white illustrations of field characters to western species. His selection of the essential in these diagrams, for which he is justly renowned, is, as usual, good. Even the most experienced field ornithologist is likely to find that Peterson has turned up some helpful clues that will prove a boon. Third, substantial progress is made in clarifying the subspecies problem for the beginner. The hopeless confusion that results from the names of the current check-list, which so often completely obscure specific units, is met by supplying a good set of names for full species, together with a list of the names of subspecies, so that a novice may sort out the tangle of racial names to which he may have been exposed. Furthermore, the ridiculousness of most field identifications of races, and the scientific inaccuracy of them are nicely brought out. Only a few races that are possessed of obvious field characters are selected for particular treatment.

Peterson makes it clear in the introduction that his book does not replace, but complements, Hoffmann's handbook. A student needs both. Peterson's guide will serve better for identification, because of the plates, but it does not include in comparable degree the natural history—details of distribution, habitat, behavior, and song—of which Hoffman through long western field experience could speak. Nor does it provide as much assistance in learning of postures and attitudes of birds as do the Allan Brooks drawings in the Hoffman guide.

Although Peterson draws attention to the sharply marked habitats and zones in the western United States, actually only limited help is given the beginner in these matters. To illustrate, the statement that the Phainopepla breeds "chiefly in arid lowlands" does not go far enough to provide appreciable aid. But such limitation is deliberate and no doubt a practical necessity; in many instances the essence of the habitat is clearly indicated.

Considering the time involved in preparation of the guide we encounter few errors. Sample items that have been noted or that have been brought to my attention are as follows: the breeding ranges of the Gadwall and Cinnamon Teal should be outlined to include central and southern California, respectively; the winter range of the Varied Thrush should include coastal southern California; not all Chestnut-backed Chickadees have rufous sides as stated, the absence of which in *P. r. barlowi* might well have served as a diagnostic character for this race, for it can easily be identified in the field. Elimination of the awkward and unnecessary possessive endings on names of birds would have pleased western students as conforming with prevailing custom on the Pacific coast.

To obscure the value of this book through mention of a few shortcomings would be wholly wrong. Peterson has done a great service to ac-

tive and prospective bird students in a large section of the country by working up this guide. Also, he has taken an important stand in favor of less emphasis on subspecies on the part of the field amateur, which attitude expressed in a book of this kind we may expect will have a distinctly beneficial effect.—ALDEN H. MILLER.

Two contributions on the subject of attracting birds have been received which deserve review, but because of limited space, they can merely be brought to notice here. "Bird houses, baths and feeding shelters, how to make and where to place them" by Edmund J. Sawyer, is a completely revised third addition of a bulletin issued by the Cranbrook Institute of Science, Bloomfield Hills, Michigan (1940; 35 pp.; 20 cents). More comprehensive is "The Audubon guide to attracting birds," edited by John H. Baker (Doubleday, Doran and Company, Inc., Garden City, N. Y.; xviii+268 pp., illus.; $1.50) which treats of photography, banding, planting, waterfowl areas and sanctuaries in addition to bird houses and baths. —A. H. M.

MINUTES OF COOPER CLUB MEETINGS

FIFTEENTH ANNUAL MEETING

The fifteenth annual meeting of the Cooper Ornithological Club was held Friday, April 11, to Sunday, April 13, 1941, at the Museum of Vertebrate Zoology, Berkeley, California. On Friday morning the meeting was opened by E. Lowell Sumner, Jr., president of the Northern Division, and a welcome extended to members and visitors. George Willett spoke in response for the members of the Southern Division.

After the annual business session, the following papers were presented: Light versus activity in the control of the sexual cycle of birds: the role of the hypothalamus, by Albert Wolfson; Observation of a condor in the San Jacinto Mountains, by Richard H. May (read by J. S. Dixon); The passing of the Shasta vulture, by Loye Miller; Variation in *Dendragapus* in the Coast Range of California, by James Moffitt; A fossil flamingo from the Miocene of North America, by Alden H. Miller.

Friday afternoon: Peregrine falcon populations in western North America: a request for information, by R. M. Bond; Problems of wild turkey management in Missouri, by A. Starker Leopold; Is there mimicry in the feeding behavior of birds? by Junea W. Kelly; Pairing responses of free-living valley quail to hormone pellet implants, by F. W. Lorenz and J. T. Emlen, Jr.; Feeding habits of the black oyster-catcher, by J. Dan Webster; Food of the spotted owls at Whitaker's Forest, Tulare County, by Joe T. Marshall, Jr.

In the latter part of the afternoon, members and friends visited the gallery of the Museum of Vertebrate Zoology, where the scientific collections were open to inspection.

Saturday morning: The working day of the robin, by Robert C. Miller; Territorial behavior of the American woodcock (*Philohela minor*), by Frank A. Pitelka; Habits of the Mearns quail, by Loye Miller; Experimental analysis of the breeding cycle in the tricolored red-wing, by John T. Emlen, Jr.; The nesting of the ptarmigan on Mount Baker, Washington (illustrated), by William T. Shaw; Variation in *Corvus corax* in North America, by George Willett; Notes on the roosting habits of the chestnut-backed chickadee and the Bewick wren (illustrated), by Laidlaw Williams.

Saturday afternoon: Highlights of condor watching, by Carl B. Koford; The federal wildlife restoration program (illustrated by the motion picture, "Haunts for the Hunted"), by Stanley G. Jewett; Bird life in the eastern Mohave Desert (illustrated), by David H. Johnson; "Galapagos," a film taken on the Lack-Venables Galapagos Expedition of 1938-39, by Robert T. Orr.

On Saturday evening, approximately 90 members and guests attended the annual dinner at the Berkeley Women's City Club. Mr. Andrew Shirra Gibb presented his excellent motion pictures in color of birds taken in the vicinity of Monterey.

ANNUAL BUSINESS MEETING

The annual business session of the Cooper Ornithological Club was called to order in Room 2503, Life Sciences Building, University of California, Berkeley, California, at 9:30 a.m., Friday, April 11, 1941, with Vice-president Alden H. Miller in the chair and George Willett acting as secretary.

The minutes of the Annual Meeting of 1940 were read and approved.

The Chairman appointed as a committee to examine proxies, John McB. Robertson, Chairman, John T. Emlen, Jr., and Jean M. Linsdale, and as a committee to present nominations for Directors for the ensuing year, John G. Tyler, Chairman, Loye Miller and Joseph S. Dixon.

The meeting then adjourned to meet in the same room at 9:00 a.m., April 12, 1941.

The business session was resumed at 9:00 a.m., Saturday, April 12, 1941, in Room 2503 Life Sciences Building, University of California, Berkeley, California, with Vice-president Alden H. Miller presiding.

The Proxy Committee reported that, of a total membership of 891, 77 members were present in person and 414 were represented by proxies. The Chairman therefore declared a quorum present.

The Secretary reported election by the two divisions of the Club since the last annual meeting of 94 members, from and including Number 1136 on the Club Membership Roster, to and including Number 1229 on said roster. On motion by George Willett, seconded by Loye Miller and duly carried, the election of these members was ratified. The Secretary then read the following applications for membership in the Club: Leslie G. Hawkins, proposed by Hildegarde Howard; Daniel O. Kjerulf, by William T. Shaw, and Jackson Dan Webster, by Alden H. Miller. On motion by George Willett, seconded by Loye Miller and duly carried, these applicants were elected to membership.

The Nominating Committee presented the following nominations for Directors for the ensuing year: John S. Appleton, W. Lee Chambers, Hilda W. Grinnell, Jean M. Linsdale, Alden H. Miller, J. R. Pemberton, Howard Robertson, John McB. Robertson and George Willett. On motion by Loye Miller, seconded by L. W. Taylor and duly carried, the nominations were closed and the nominees declared elected.

The Treasurer's Report was read by Treasurer John McB. Robertson. On motion by Loye Miller, seconded by E. Lowell Sumner, Jr., and duly carried, this report was accepted.

Hilda W. Grinnell presented the following resolutions regarding the death of J. S. Cooper, Junior Vice-president of the Board of Directors of the Club, and son of J. G. Cooper, for whom the Club was named. Mrs. Grinnell also gave a very interesting summary of the history of Mr. Cooper's family.

WHEREAS, in the death of James S. Cooper, for nearly forty years a devoted member of the Cooper Ornithological Club, a past President of the Northern Division, and a charter member of the Board of Governors, our organization has lost a valued member; and

WHEREAS, many of us of the Cooper Ornithological Club have had occasion to know of his constant readiness to serve the Club, especially in his chosen field of accounting, and also to become individually aware of his sincere interest in this Club, which bears his father's name; therefore be it

RESOLVED, that we of the Cooper Ornithological Club, in annual meeting assembled at Berkeley, California, on April 12, 1941, hereby express our deep sorrow at this loss which has come to the Club; and be it further

RESOLVED, that a copy of these resolutions, with an expression of our sincere sympathy, be sent officially from the Club to Mrs. Cooper.

On motion by Mrs. Grinnell, seconded by Lowell Sumner and unanimously carried, the resolutions were adopted.

On motion by George Willett, seconded by Loye Miller and unanimously carried, a vote of thanks was extended to the Local Committee on Arrangements for the Fifteenth Annual Meeting.

The meeting adjourned at 9:30 a.m.—GEORGE WILLETT, *Secretary*.

GOVERNORS' MEETING

The nineteenth annual meeting of the Board of Governors of the Cooper Ornithological Club was held at International House, Berkeley, California, on April 11, 1941. President Tyler called the meeting to order at 8 p.m., with the following members present: Amelia S. Allen, Richard M. Bond, Harold C. Bryant, H. W. Carriger, Frances Carter, W. Lee Chambers, Joseph S. Dixon, John T. Emlen, Jr., Hilda Wood Grinnell, Eric C. Kinsey, Jean M. Linsdale, Alden H. Miller, Loye Miller, Robert T. Moore, Irwin D. Nokes, Harry R. Painton, John McB. Robertson, Tracy I. Storer, E. Lowell Sumner, Jr., John G. Tyler, and George Willett.

Proxies were presented as follows: Clinton G. Abbott, J. S. Appleton, H. L. Coggins, Raymond B. Cowles, Joseph Mailliard, Herbert N. McCoy, Harold Michener, J. R. Pemberton, Gayle B. Pickwell, Sidney B. Peyton, and Sherwin F. Wood, held by Alden H. Miller; Frank N. Bassett, Luther Little, Guy C. Rich, and Howard Robertson, by W. Lee Chambers; Louis B. Bishop, by George Willett.

Minutes of the eighteenth annual meeting of the Board of Governors were read and approved. The report of the Business Managers for 1939 was presented by Mr. John McB. Robertson, which report is appended to these minutes. A letter from Mr. J. S. Cooper, reporting for the auditing committee, which consisted additionally of H. N. McCoy and S. F. Wood, indicated that the accounts had been found to be in good order. Loye Miller, seconded by George Willett, moved that the report of the auditing committee be adopted. On motion by Joseph Dixon, seconded by T. I. Storer, the report of the Business Manager was accepted.

President Tyler called for the report of the Editor, which was presented by Alden H. Miller. On motion of T. I. Storer, seconded by George Willett, this report was accepted.

Discussion ensued concerning problems arising in the fixing of dates of membership and the acceptance of resignation of members. It was agreed informally that the Secretary and Treasurer act for the Board in these matters.

A proposal from Dr. Lawrence E. Hicks, Secretary of the American Ornithologists' Union, that the Cooper Ornithological Club affiliate with the Union was presented for consideration. The proposal involves no financial obligation and carries the privilege of naming a special member of the Club to sit on the council of the Union,

the purpose being to promote the common interests of the organizations in the field of ornithology. After extended discussion it was voted on motion of E. L. Sumner, seconded by R. T. Moore, to affiliate with the Union in this way.

Loye Miller, seconded by H. C. Bryant, moved that the Editor be empowered to arrange for purchase of reprints from the Condor by the Association of Park Naturalists; motion carried.

George Willett moved that a vote of thanks be extended to the local committee for the efficient conduct of the Fifteenth Annual Meeting of the Club in Berkeley. Motion seconded by Loye Miller and unanimously carried.

The President was asked to appoint a committee to prepare an appropriate expression of the loss felt by the Board and the Club in the recent death of Mr. J. S. Cooper. Hilda W. Grinnell, W. Lee Chambers and Alden H. Miller were named.

The Board accepted with pleasure the invitation of members of the Club in San Diego, extended through Mr. Clinton G. Abbott, to hold the Sixteenth Annual Meeting in 1942 in that city.

All officers of the Board were re-elected for the year 1942.

Adjourned.—ALDEN H. MILLER, *Secretary*.

NORTHERN DIVISION

MARCH.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, March 27, 1941, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with about 140 members and guests present. President Sumner turned the meeting over to the Vice-president, R. M. Bond, who presided for the remainder of the evening. Minutes of the Northern Division for February were read and approved. Two names were proposed for membership: Wilfred E. Cawelti, Box 322, Maricopa, California, and Benjamin B. H. Taylor, 1830 San Antonio Avenue, Berkeley, California, both by Alden H. Miller.

B. C. Cain expressed the concern felt by the Conservation Committee over a possible change in the administration of Point Lobos Reserve which might endanger the established policy of its maintenance as a natural area. It was unanimously decided that resolutions be drawn up and sent to the Division of State Parks, and it was further urged that letters be sent by individual members. (Copy of the resolutions filed with the minutes of this meeting.)

Mr. Milton Ray briefly reviewed a book, The Cuckoo, by Edgar P. Chance, which had recently appeared in England and was also published in the United States by Scribners.

Field notes were opened by Frank G. Watson, who had observed Cliff Swallows around the Life Sciences Building, March 27. Since they appear a month earlier in the central valleys, he asked for other records. Various members reported them from different localities: Woodland, February 22; Ventura County, March 4; Alvarado, March 22; and Alameda, March 24. One earlier record from the Berkeley campus was March 18. Mr. Covel had first seen a Black-headed Grosbeak in Oakland, February 1. Mr. Cain's group had noted a female Wood Duck, 3 Black-crowned Night Herons and some Rough-winged Swallows at Mountain View Cemetery. A Troupial, possibly an escaped bird, was seen carrying palm fibres into an oak tree. From a point 20 miles north of Yuba City there was reported a White-tailed Kite, March 9.

The main part of the program was a delightful presentation, "Birds of the Sierra in Kodachrome," by H. D. Wheeler and Ruth Wheeler, of Pacific Union College, Angwin, California. Both lantern slides and motion pictures were shown.

Adjourned.—FRANCES CARTER, *Recording Secretary*.

APRIL.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, April 24, 1941, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Mr. Alden H. Miller presiding and about 30 members and guests present. Minutes of the Northern Division for March were read and approved. Names proposed for membership were: (Mrs.) Winifern Wood Swarth, 2800 Prince Street, Berkeley, California, by Hilda W. Grinnell; Miss Josephine Frances Crowley, 259 Buena Vista Avenue, San Francisco, California, and Paul P. Woelz, Quincy, California, both by Joe T. Marshall, Jr.

With regard to the administration of Point Lobos Reserve, the encouraging report was received that Mr. Wilson, the present custodian, would be retained for the present.

Mrs. Sheldon announced that the state convention of the National Audubon Society would be held at Monterey, May 9-11, and gave details about the wildlife photography contest.

The meeting was devoted to reports of observations by members who had been in the field. Mrs. Grinnell read a letter from Mr. Ware C. Little, of Piedmont, who recorded a two years' acquaintance with the free-living Troupial reported at the last meeting by Mr. Cain. The occurrence of a sickness affecting Pacific Loons and causing many deaths among them was reported by several members, at Newport Bay, Point Lobos, the 17-Mile Drive and Moss Beach. An extraordinary invasion of Lake Merritt by loons of three species had been noted by Mr. Covel.

Mrs. Kelly remarked on the scarcity in numbers of individuals in the different bird species seen recently in Sonoma County, wondering whether that might be an effect of late snow on Mt. St. Helena. Mrs. Sheldon described the pleasure of seeing all three species of oriole, Bullock, Arizona Hooded and Scott, in Borego Valley on Easter Sunday. Milton Seibert gave a number of first records for the season: Lazuli Bunting, April 13 (Sunol); Lincoln Sparrow, April 18; and Warbling Vireo, April 20; young of the California Thrasher were seen April 13 at Sunol. Vincent Mowbray listed among the birds nesting in Arroyo Mocho near Livermore, Lawrence Goldfinch, Mourning Dove, Brown Towhee, and Black Phoebe, and in an unusual site, apparently a gopher hole in a cliff, a Titmouse nest. On a desert trip, Mr. Covel was surprised to find Cactus Wrens nesting in buildings. Mr. Miller replied that departure from the cactus habitat was often seen in the cactus wrens of Imperial Valley, while those on the coastal slopes remained in the cactus patches.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

May.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, May 22, 1941, with Mr. Alden H. Miller presiding and 38 members and guests present. Minutes of the Northern Division for April were read, corrected and approved. There were no proposals for membership.

Field observations were given by several members. Milton Seibert had seen a Band-tailed Pigeon near Mills College, April 27. He had recorded the nest of a Black-chinned Sparrow in Santa Clara County, May 10. Dr. Haley recounted the experience, amusing in retrospect, of having his handkerchief snatched away by an irate owl at which he had waved it, on the campus at dusk. Mrs. Allen had found a Phainopepla's nest in Arroyo Mocho, May 5. Mr. Miller had noted a Varied Thrush in Berkeley as late as April 30, whereas the latest record in previous years was April 18. Vincent Mowbray had seen a White-tailed Kite near Colusa.

The speaker of the evening, Mr. George A. Bartholomew, gave a full and interesting account of his months of observation on the distribution and behavior of Brandt and Farallon cormorants on San Francisco Bay.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

SOUTHERN DIVISION

MARCH.—The regular meeting of the Southern Division of the Cooper Ornithological Club was held in the Los Angeles Museum of History Science and Art on Tuesday, March 25, 1941, with President Hildegarde Howard in the chair and 21 members and guests present.

President Howard announced that the annual meeting of the Cooper Club would be held in Berkeley and urged all members to be present or to send their proxies. She also stated that there would be no meeting of the Southern Division in April.

At the request of the Board of Governors and the Director-in-charge of the Los Angeles County Museum, the President extended an invitation to all Cooper Club members to a tea to be held Friday, February 28, 1941, from 3 to 6 p.m. in celebration of the opening of the New Division of Education of the museum.

The meeting was then turned over to the members who reported observations made by them. Sidney B. Platford reported seeing a few Costa Hummingbirds at the Tucker Ranch. John McB. Robertson had observed that spring migration was late. Dr. Howard reported Cliff Swallows two weeks earlier than usual at San Juan Capistrano. W. J. Scheffler stated that Golden Eagles had well incubated eggs on March 7 and that Red-tailed Hawks had young on the same date; also that he had seen a flock of 20 cranes at San Juan Capistrano.

George Willett told of his recent trip to the coastal islands. He spent eight days on San Clemente Island, experiencing bad weather. Birds noted were: 200 Ravens, Rock Wrens, Bewick Wrens and Horned Larks. On the west end of Santa Catalina Island he saw the island form of Allen Hummingbird and two flocks of Black Brant numbering 20 and 30 each. On March 17, on Anacapa Island he found the Brown Pelican with young, and saw Rock Wrens, Bewick Wrens, Golden-crowned Sparrows, Barn Swallows, and White-throated Swifts, but no Cliff Swallows.

Irwin B. Dixon reported Band-tailed Pigeons numerous in the Palomar Mountains. He also reported an interesting observation regarding a Great Blue Heron colony which had been destroyed by removal of the trees in which they had nested. The birds had found a new place of residence in a eucalyptus grove, but he failed to see them carry any nesting material, until on one moonlight night, attracted by a considerable amount of noise, he found them busy building nests.

W. J. Scheffler reported that he and Dr. Loye Miller, while on a trip to Arizona had found Mearns Quail to be numerous, also he stated that they had noted a Spotted Screech Owl on February 4, 1941.

Adjourned.—IRWIN D. NOKES, *Secretary.*

For Sale, Exchange and Want Column.—Each Cooper Club member is entitled to one advertising notice in any issue of The Condor free. Notices of over ten lines will be charged for at the rate of 15 cents per line. For this department, address JOHN MCB. ROBERTSON, Buena Park, California.

BIRD REFERENCE work of any kind done at the U. S. National Museum for distant ornithologists. I have full access to the collections and library. Terms: 50 cents per hour. Address: DR. E. M. HASBROUCK, *U. S. National Museum, Washington, D. C.*

FOR EXCHANGE—The Barnes Museum offers in exchange for similar specimens: mounted specimens and eggs of North American birds; over 200 varieties of North American moths and butterflies (the latter spread, and all specimens accurately classified and accompanied by reliable data). We hold state and federal permits. Send list of what you have and what you need.—R. M. BARNES, *Lacon, Illinois.*

FOR SALE—The Auk, 1903-1916, fourteen volumes, text as new, binding fair. Bird-Lore, vol. I, lacks no. 3; vol. II, complete; vol. III, lacks no. 5. The Condor, vols, XI, XII, XIII, XIV, XVII, XVIII, XIX, XX, XXIX, XXX, and on to include XLII, mostly unbound, text perfect, a few numbers missing. Journal of Heredity, 1914 to 1931, as new. Who wants any of them, for how little? —NED DEARBORN, *Hilton Village, Virginia.*

FOR SALE—New copies of Bailey's Handbook of the Birds of the Western United States, and the new Peterson's Field Guide to Western Birds.—F. M. DILLE, *Nogales, Ariz.*

FREE—Any one needing the following numbers of The Nidiologist to complete their file may have them free on request: vol. 2, nos. 3, 5, 6, 12; vol. 3, nos. 6, 8, (10-11), 12.—FRANK N. BASSETT, *722 N. Orange Drive, Los Angeles, Calif.*

TRAPS FOR SALE BY THE WESTERN BIRD BANDING ASSOCIATION

List of Traps	In U. S., west of Mississippi River; prices postpaid	East of Mississippi River and in Canada; prices postpaid
Modesto Funnel Trap,[1] 24″x24″x8½″	$4.50	$5.00
WBBA Government Sparrow Trap,[2] 14″x28″x10″	4.50	5.00
WBBA One-cell Trap,[3] Small, 5″x7½″x8″	1.00	1.15
WBBA One-cell Trap,[4] 7″x11½″x8″, Large	1.25	1.40
WBBA Warbler Trap,[5] 8½″x15½″x9½″	3.00	3.25
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